

YELLOWSTONE ROADS AND BRIDGES
Yellowstone National Park
~~Park County~~ Teton County
Wyoming

HAER No. WY-24

HAER
WYO
20-YELNAP
9-

REDUCED COPIES OF MEASURED DRAWINGS
WRITTEN HISTORICAL & DESCRIPTIVE DATA

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD
YELLOWSTONE ROADS AND BRIDGES

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Location: Grand Loop Road and other roads in Yellowstone National Park, Wyoming, Montana and Idaho

Construction date: c. 1870-1966

Designer: U.S. Army Corps of Engineers, National Park Service, Bureau of Public Roads, Federal Highway Administration

Present Owner: National Park Service, U.S. Department of the Interior

Present Use: Park highway and scenic road system

Significance: The construction of early roads in the Nation's first national park was carried out by the U.S. Army Corps of Engineers, establishing a precedent later employed in other early parks. After creation of the National Park Service in 1916, the new agency carried out a series of road projects before delegating major road work to the Bureau of Public Roads. The Yellowstone park roads, constructed over a long period by the various parties, were designed to carefully relate to the park's striking wilderness environment. Road corridors were located to minimize damage to their surroundings and a number of rustic bridges and structures were utilized to help integrate the roads with the landscape. Reconstruction of the system since Mission 66 has destroyed much of the historic integrity of the roads; however, they generally follow historic alignments and some of the rustic structures remain in use.

Project Information: This project was conducted in summer 1989 under the sponsorship of Yellowstone National Park, the Historic American Engineering Record, and the Rocky Mountain Regional Office, all entities of the National Park Service, U.S. Department of the Interior.

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HAER No. WY-24

(page 2)

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CHAPTER I

THE EARLY YEARS 1872-1883

the public highway was cut through the timber over rolling ground with stumps left from 2 to 20 inches above the ground, and instead of grading a hill it went straight up on one side and straight down on the other.

--Carrie Strahorn
Fifteen Thousand Miles by Stage, 1880

Yellowstone National Park remained a mysterious land until late in the nineteenth century. For years, tales of this wondrous area were recounted, but most of the descriptions were questioned or denied. In 1860, weather, scheduling and rugged topography prevented Capt. William F. Reynolds, the head of a government survey expedition to explore the Yellowstone and Missouri Rivers, from penetrating the present park boundaries. However, he did produce a map based upon the celebrated Jim Bridger's description of *Terra Incognita*, and in his report Reynolds wrote, "I cannot doubt, therefore, that at no very distant day the mysteries of this region will be fully revealed, and though small in extent, I regard the valley of the upper Yellowstone as the most interesting unexplored district in our widely expanded country."¹

Reynolds' perceptions were true. The next decade saw official and semi-official expeditions successfully explore the Yellowstone, each making contributions of different sorts. As late as 1869, three years before the park's establishment, Charles Cook of the Folsom, Cook and Peterson Expedition submitted a description of the area to *Lippincott's Magazine* which elicited the response "Thank you but we do not print fiction."² Nevertheless, prompted by the descriptions, the urging of members of these expeditions and of other interested citizens and politicians, Congress set aside the area as the Nation's first national park on 1 March 1872.

The Langford Years, 1872-1877

for we go through timber as thick as the hair on a dog's back, and down the longest, steepest mountain on the road. We'll have to go through a swamp that'll mire a musketeer; and, if we're out after night, it'll be darker than the thickets in Egypt.³

In Superintendent Nathaniel P. Langford's first report to Secretary of the Interior Columbus Delano for the year 1872, he wrote, "The park is at present accessible only by means of saddle and pack trains, a mode of travel attended with many privations and inconveniences."⁴ He advised the Secretary that he would report on the park after he had completed a "thorough exploration." Shortly afterwards, he joined the United States Geological Survey expedition led by Ferdinand V. Hayden and spent the next two months exploring the Yellowstone and Teton area. As a member of such a well organized and scientifically focused group, Langford probably added much to his prior knowledge of the topography and of the locations of the significant points within the park.⁵

Among Langford's concerns about administering the park was the need for a park road system and good wagon "approach" roads, which resulted in a road system that was an almost mirror image of the present-day configuration. His idea for a "circuit of perhaps ninety miles" would enable visitors to reach all of the significant scenic or scientific wonders and would become the genesis of the Grand Loop.⁶ Carriage-bound tourists would be able to explore the interior of the park from these important points.

In 1872, there were two routes into the Yellowstone: travel by Union Pacific Railway to Corrine, Utah, then via stage for 438 miles on the Montana Stage Line or the Wells Fargo and Company lines to Virginia City, Montana; or by river transportation to Fort Benton, Montana, then stage conveyance to Bozeman or Virginia City, Montana. Between 1872 and 1873, the final leg of the journey into the park was over very rough "roads," either from the north entrance, through the Yankee Jim Canyon to Mammoth Hot Springs, or through the west entrance, via the Madison Canyon to the Lower Geyser Basin.

Gilman Sawtell built the west entrance road which originated in Virginia City, Montana, and reached the Lower Geyser Basin by way of the Madison Canyon in 1873. Sawtell named the toll-free west entrance road "The Virginia City and National Park Free Road," in order to differentiate it from the North Entrance toll road. Sawtell, who catered to park visitors at his hotel on Henrys Lake, observed the behavior of his clientele toward the park resources, and in 1874, offered his services as superintendent for the park. Sawtell felt that a person who lived nearer the park could protect it better.⁷

The privately built toll road to Mammoth Hot Springs from Bozeman, completed in 1873, covered 75 miles. The first

Yellowstone National Park guidebook, Henry J. Norton's *Wonderland Illustrated: or Horseback Rides Through the Yellowstone National Park*, described it as an "excellent wagon road."⁸ However, some travelers revealed more critical views about the condition of the road in published accounts of their journeys. In her reminiscences, Mrs. George Cowan wrote:

The road through the Yellowstone canyon below Cinnabar was scarcely more than a trail, but by careful driving, unhitching the horses and drawing the wagon by hand over the most dangerous places, we made it safely.⁹

Edwin Stanley, a Methodist minister who toured the park in 1873, called the road, "a passable wagon road;"¹⁰ but another account called it "dangerous"

as an upset wagon inevitably lands in the river and is lost. The wagon road winds among these masses and over a projecting spur, high above the river thence descends over boulders to the level of the stream. It is a bad place for a long team and in one place the animals have to be detached or pulled at right angles up the bank in order to give a wagon room to make the turn.¹¹

The situation created by the conditions of the roads and the imposition of tolls on the tourists worried Langford. He perceived that the Yellowstone National Park would become a destination for travelers from across the United States and abroad, and with good wagon roads, the park could provide the government with considerable revenue. Langford requested from the Secretary of the Interior an explanation of his authority in regard to the building of public houses and the protection of the rights of the visitors, since he had received numerous applications for leases of property for lodging purposes at the important points in the park.¹² Regarding the protection of visitor rights, he feared that the toll-road company that had recently "graded a few steep hills in the line of travel" would charge the park visitor exorbitant rates.¹³

At the time of the park's creation, most road building responsibility across the country lay with the local towns and/or private road companies, and road conditions throughout the country were considered to be in a "wretched state of repair and neglect."¹⁴ The territories of Montana, Wyoming, and Idaho were crisscrossed with Indian, fur trade, exploring expeditions, and emigrant trails, military roads, and stage and freight line roads. In 1869, the Union Pacific Railroad crossed the southern

part of Wyoming Territory connecting both coasts, but it would be 1879 before the Utah Northern, a branch of the Union Pacific, extended to the Montana Territory boundary. The Northern Pacific Railroad, which reached the eastern boundary of the Montana Territory in 1881, joined the Utah Northern west of Butte in 1883.

During the park's infancy, the area was considered an important "knot" in geographic determinants of migration. All of the major trails and/or wagon roads were to the north and west in Montana Territory and to the east and south in Wyoming Territory.

The enabling legislation for Yellowstone National Park allowed the Secretary of the Interior to "make and publish such rules and regulations as he may deem necessary or proper for the care and management of the same," but it would take the passage of the Lacey and Hayes Acts in 1894 before specific rules were outlined. In his efforts at establishing the creation of the park, Professor Hayden, who had done the survey of the Yellowstone area for the U.S. Geographical and Geological Survey of the Territories, was "compelled to give a 'distinct pledge [that] he would not apply for an appropriation for several years at least,'" otherwise the legislation would probably not pass. Thus, no appropriations for management of the park, the construction of roads and trails, or salaries was requested in 1872.¹⁵ Apparently without knowledge of this "distinct pledge," in February 1873 Langford appealed for an appropriation of \$15,000 to enable him to open the park and to construct roads. In a letter to the Secretary Delano, Langford wrote that the opening of roads would encourage "men of entire reliability" to lease properties, which would in turn "lead them to preserve, in all their beauty, the surroundings of the springs."¹⁶

Not being successful with the Forty Second Congress, Third Session, Langford made additional requests of the Forty Third Congress during the fall of 1873. Territorial governors Benjamin Franklin Potts of Montana and John A. Campbell of Wyoming wrote to Secretary of the Interior Delano seeking money for the protection and improvement of the park, including a "liberal appropriation to employ a resident Superintendent of the park, and make such roads as are necessary, and preserve from spoilation the numberless curiosities of that wonderful region".¹⁷

Again Langford had no success, nor would any result from repeated requests including one based upon Capt. William A. Jones' expedition of 1873. Captain Jones had surveyed northwestern Wyoming for a wagon road from Camp Brown, Wyoming, via Lake Yellowstone, to Fort Ellis, Montana. He recommended a route

through the park that followed the Upper Yellowstone River, via the east side of Lake Yellowstone, to Tower Junction and on to Gardiner through Mammoth Hot Springs. While Jones suggested that "There was good reason for believing that the Yellowstone National Park will, in time, become the most popular summer-resort in the country, perhaps the world, this, of itself, is a sufficient reason for opening the way to it at once." His proposal was mainly based on economics; his route would save great distances in reaching the major cities of Montana and open the Wind River Valley and the Teton Basin for settlement.¹⁸

Professor Hayden wrote Secretary Delano pointing out that "good roads approaching the park from various points can be readily made by private enterprise. A moderate rate of toll might be levied on visitors to keep these roads in repair." He felt it was the government's responsibility to construct roads to the principal points in the park, but income from the leases of public facilities could be used to maintain the roads. He advised the Secretary that if the government initiated steps toward opening the park, private enterprise would be ready to establish the necessary stage lines and telegraph lines.¹⁹

In 1874, Superintendent Langford asked for an appropriation of \$100,000 for the protection and improvement of the park. He stated more than 500 people visited the park during 1873 arriving on "good roads to its borders," but that accessibility in the park was limited to packtrains. He explained again to the Secretary that the construction of roads would in turn lead to better protection of the park by responsible persons and an income for maintenance by the leases. Langford pointed out that since the park's creation, more than \$150,000 in destruction to the park had taken place. Without an adequate appropriation, the other choice for the needed improvements and protection would be leasing the entire park for a term of years to responsible persons who would provide the needed improvements and protection.²⁰

Also in 1874, Secretary of War William Belknap sent a recommendation from the Commanding General of the Department of the Platte for construction of a military road between Green River, Wyoming, via Yellowstone National Park, to Fort Ellis, Montana.²¹ However, none of the 1874 recommendations for appropriations were satisfied.

Two more military expeditions in 1875 demonstrated the Army's continuing attention to the park. Secretary Belknap made a tour through the park with Lt. Gustavus Doane and retired Brig. Gen. W. E. Strong. The other military expedition led by Capt. William Ludlow produced sound recommendations for the improvement and

protection of the park. A guest of the expedition, William Bird Grinnell, later editor of *Forest and Stream* magazine and a leading late nineteenth-century conservationist, drew the Nation's attention to the "reckless destruction" of elk in the park. Eventually, some of Captain Ludlow's recommendations came to fruition:

1. Transfer of the park to the control of the War Department until such time that a resident civilian Superintendent can hire mounted police to provide protection.
2. troops should be stationed at Mammoth, Lake, and Geyser Basin
3. an appropriation of \$8,000 to \$10,000 for a thorough and accurate topographical survey to locate the best routes for roads and trails
4. an observatory on Mount Washburn
5. rough bridges constructed where needed
6. worst portions of trails corduroyed
7. lodging facilities constructed at Mammoth, the bridge, the falls, the lake, and the geyser basins
8. visitors should be forbidden to kill any game
9. arms and spoils should be confiscated and violators liable to prosecution²²

However, despite Captain Ludlow's recommendations for Yellowstone's management, no appropriation was approved after the submittal of his report in 1876.

It was 13 June 1878 before the first appropriation of \$10,000 for the improvement and protection of Yellowstone National Park passed Congress.²³ A new Superintendent, Philetus W. Norris, appointed in 1877, would begin the first road projects in the park.

The Norris Years, 1877-1882

Philetus W. Norris wasted little time in getting to Yellowstone National Park after his appointment as superintendent on 19 April 1877. Norris, who had made two previous visits, would take a very aggressive approach on road construction and other issues. Prior to his arrival, only pack trains could manage the park "roads;" but in 1877, the first wagons entered the park. One, an ox-drawn wagon bound from Gardiner to the Clarks Fork mines just east of the park, had to be disassembled before it could be taken over Baronett's Bridge. This bridge, built in 1871 by a Scot, Collins J. "Yellowstone Jack" Baronett, was the first built across the Yellowstone River and predated the park by one year.

Then during August of 1877, Maj. Gen. O. O. Howard pursued Chief Joseph and the Nez Perce with his troops, wagons, and horses along the Madison River to the Lower Geyser Basin, and on to Nez Perce Creek. At the creek, Howard's men had to cut a "road" over Mary Mountain on the Marys Lake trail to the Yellowstone River. From there, the group followed the Nez Perce by way of Dunraven Pass to Baronett's Bridge.²⁴ On 30 August 1877, a band of the Indians partially destroyed the bridge by burning stringers on the east abutment.

Norris did not receive an appropriation the first year, but he understood the necessity for pressing for sufficient funds to "survey and plainly and permanently mark its boundaries, and also salary of a Superintendent to justify his residence there, and efforts to protect the wonders, open roads, and assist tourists with information and guidance."²⁵ In fact, before he officially arrived at the park, he explored the Slough Creek-Rosebud area for another potential northern route.²⁶ During the 1877 season, Norris placed a "large number of spirited cautions against fire and depredations in the park." These printed cloth signs were affixed to trees at strategic points of interest.²⁷

In Norris' first report to the Secretary of the Interior, he devoted a large section to transportation issues. The construction of a wagon road from Mammoth Hot Springs to Henrys Lake, via Tower Falls, Mount Washburn, Cascades, Yellowstone Falls, the Lake, Firehole Basin, and the Nez Perce route through the west side, was deemed a "pressing necessity." Norris felt this route would connect almost all the major points of interest, the existing north and western approach roads, and the southern approach route proposed by Capt. William A. Jones in his 1873 exploration report of the Wind River Valley and Togwatee Pass; and his other northern approach route from near the forks of the Yellowstone via Slough Creek, to the Stillwater River and on the navigable part of the Yellowstone River. Norris also proposed immediate construction of a bridle path from the Stillwater River to the Upper Geyser Basin, via the Clarks Fork mines and Soda Butte, into the park through the petrified forests, to Amethyst Mountain, Pelican Creek and the outlet of Lake Yellowstone, then by way of Shoshone Lake to Old Faithful in the Geyser Basin. The other bridle path he recommended would connect the Firehole to Mammoth Hot Springs via Gibbons Fork and Gardiner Falls. Norris recognized "many short, and some tolerably elevated, bridges will be required" and "some long causeways, especially in the miry, often nearly impassable, Upper Firehole Valley [may be needed.]"²⁸

Superintendent Norris agreed that the construction of roads into and through the Yellowstone National Park would be of great

benefit to many. Not only would the "teeming throngs of tourists to the bracing air, the healing bathing-pools, and matchless beauties of the 'wonder-land'," be encouraged to come, but the opening of a route through the park would reduce the cost of transportation to the government of supplying the chain of military posts in the west. The improved transportation route through the "knot" in the Rockies would promote settlement in the nearby areas and assist with the "Indian question."²⁹

Before leaving the park for his home in Michigan, Norris realized that the question of the pre-park improvements, namely the Baronett Bridge and the McCartney accommodations at Mammoth Hot Springs, had not been legally addressed. He felt that the bridge and the hotel should be purchased by the government outright or that C. J. Baronett and J. C. McCartney should be allowed a fair preference for a ten or twenty years' lease on their holdings. Norris preferred the lease option for McCartney and Baronett and suggested to the Secretary of the Interior that leases of ten or twenty years be given for other hotel accommodations at Yellowstone Falls, the geyser basins, and at Lake Yellowstone. He also recommended leases for yacht and ferry operations at Lake.³⁰

Norris arrived in the park for his second season with the park's first appropriation of \$10,000. Due to the Nez Perce activities from the previous summer and the continuing potential threat from the Bannock Indians, Norris discarded his plans for building facilities at Mammoth Hot Springs in favor of building a road from Mammoth Hot Springs to the Lower Geyser Basin. The park road would facilitate the movement of the military from Fort Ellis, Montana, to Henrys Lake in Idaho or Virginia City, Montana, and of course, be used by the ever-increasing number of visitors to the park.³¹

Superintendent Norris began his active role in the road construction program by writing to Secretary of the Interior Carl Schurz stating that he would need to hire an assistant at a salary of \$1,000 per year so he could proceed with the road plans. He also said that he planned monies for the purchase of a small barometer, prismatic compass, field glasses, thermometer, and other necessary equipment.³² Prior to his explorations for appropriate routes, Norris took "some 20 well-armed, mounted, equipped, resolute, and reliable mountaineer laborers" to build a road up the Mammoth Hot Springs terraces and through a pass into the Gardner Valley (then known as the Gardiner Valley). Using his field glasses, Norris viewed other possible park routes in the far distances from the top of Sepulcher Mountain. He could spot the route that his party took in 1875 and he visualized a route to the south, through the park via Gibbon Canyon, Firehole

Basin, the Continental Divide, and on to the Tetons. He knew construction through the canyons and the geyser basins could prove to be difficult and dangerous, but it appeared to be the most straightforward and practical wagon route.³³

The rugged condition of this area in 1878 was described by Luther "Yellowstone" Kelly, a frontier scout, in his account of his journey through this part of the park:

In the chill mist of early morning we passed like ghosts along a rude road into the geyser basin, . . . the trail had disappeared and we were treading a crust that sounded hollow and was hot to touch. I dismounted and led my horse carefully around the thin places for fear he would break through and scald his legs. . . . At this time there were practically no trails in the park aside from the game trails, only a rough track connecting the geyser basin with Mammoth Hot Springs. The east side of the lake was heavily timbered with considerable underbrush. It was not easy traveling and the course I took, as nearly straight to the head of the lake as was feasible, was rough enough. . . . I knew there was no trail from the west side of the lake.³⁴

While Norris was exploring for new routes and examining some of the trails, a small crew began improving roads to the geyser basins and one toward Fort Ellis. They began a new road on the Gardiner River toward the falls and Lake Yellowstone and several new bridle paths and bridges. After bad weather set in the autumn, Norris relieved the construction crews, and he and several reliable scouts set off for further exploration of the mountain passes and to determine new routes for roads and bridle paths. Norris felt that exploration of the Yellowstone to Mount Washburn route and of others connecting the wagon roads approaching the park entrances were his most significant accomplishments. However, he also felt that much of the other scouting was "of considerable interest and value." Various paint pools, fossil forests, and other places of interest" were "discovered" during Norris' search for wagon road routes and bridle paths.³⁵ These features would later be described and illustrated by Professor Hayden of the U.S. Geological Survey.

In addition to the proposed work, Norris' 1878 report revealed the inhospitable conditions and the potentially difficult situations for road construction. With two veteran mountaineers, Adam Miller and B. Rowland, Norris sought a more desirable route around Mount Washburn, the unavoidable obstacle between the forks of the Yellowstone River and its falls and the lake. This route

was lower in elevation, and thus less snowy, than the existing route over the western spur of the mountain. Norris trekked through the Tower Falls Canyon, on to the canyon of Antelope Creek across the forested plateau between them, and on to the Grand Canyon of the Yellowstone. He found the spectacular plateau "very elevated, but open, smooth, and grassy, with a fine lake upon its summit, and mainly an excellent route."³⁶

From this area, Norris headed for the Yellowstone Falls area describing his venture as follows:

I sent my men with the animals to seek a route through the remaining spurs and timber to the cascade and Great Falls, instructing them to await there a day before searching for me, should I fail to arrive. Then with rifle and hatchet, afoot, and alone, I descended a side canon through all its labyrinth of windings, tangled timber, and crumbling walls, to the pent-up, roaring Yellowstone in the nearly hidden recesses of the Grand Canon. Nearly fronting me was the mouth of a yawning side canon soon hidden in its windings, somewhat above a side cascade nearly lost in spray in its fully 1,000 feet descent, and about and above me the stifling sulphur fumes of hissing fireholes, alike a serious obstacle to my purposed exploration of the canon to the falls, and a warning to leave it without delay. Through great exertion, I breathless and exhausted reached the timbered plateau, and through fast-descending, large, downy, snow-flakes ascended to the Great Falls, the thunders of which for miles came in rumbling echoes from the fearful depths. I there, in the gathering twilight, thankfully enjoyed the greeting shout and blazing camp fire of my men, just safely arrived with the welcome intelligence that they had found a route in all respects preferable to that over the mountain to Cascade Creek. . . . the snow, which was more than a foot deep before night, really benefit, plainly disclosing the various hot springs and sulphur basins, as well as the clearest edge of the Grand and side canyons, and brink of the large yawning land slides.³⁷

Not seeing any traces of hatchet-hacks or trails, Norris believed that he was the first man to explore the brink of the Yellowstone canyon. Norris concluded that any wagon road along the rim would have to be elevated and would prove very expensive. He discounted the eastern rim as impractical, but found one of the other explored routes to be preferable. Norris felt the canyon and the falls were "a leading wonder of the park and of the

world, every way worthy of a route along or as near as possible to its misty and sulphur-tinted walls."³⁸

Norris made his way to Lake Yellowstone, but deep snow and Indian activity prevented completion of a planned trip around the lake. Instead, he departed Steamboat Point for Mammoth Hot Springs, via Pelican Creek, Amethyst Mountain, the forks of the Yellowstone and the East Gardiner canyon. Shortly after his return home to Norris, Michigan, he summarized his thoughts and proposals in his annual report for 1878. In regard to transportation and construction of roads, Norris believed the park needed to open a wagon road along the route he explored, as well as a route that would complete a circuit passing by the great wonders of the park--Lake Yellowstone, Yellowstone Falls, and the Canyon. The building and extension of railroads and steamboat service, plus coach service to nearby communities would pressure the park to complete these wagon roads. The superintendent felt a trail was needed from the Upper Firehole Basin to the trails around Heart, Lewis, and Shoshone Lakes and around the eastern shore of Lake Yellowstone. One would follow Pelican Creek to the East Fork of the Yellowstone at the mouth of Soda Butte. Norris called for a new crossing near the forks of the Yellowstone River, which would be preferable to the dangerous, burned and decayed Baronett Bridge and to the newly commenced miner's bridge above the Baronett Bridge.³⁹ At the close of 1878, there were 103 miles of road, or in some cases, trails in Yellowstone National Park.

The isolation of the park required that Norris purchase necessary construction and maintenance equipment in Michigan before the beginning of his third year of administration. He scheduled the purchases for shipment to Bismarck, Dakota Territory, on the first steamboat heading up the Yellowstone River. Luckily, his shipment missed the connection for loading on the ill-fated steamboat Yellowstone, which was lost on the Buffalo Rapids.

Norris and the equipment later arrived in Fort Benton and were then freighted to Bozeman by way of Helena. Norris made the 3,000-mile trip from his Michigan home to Mammoth Hot Springs by many forms of travel: railroad, steamboat, freight wagon and coach. Heavy rains in June caused the shipment of supplies to be delayed as the roads were nearly impassable.⁴⁰

Norris felt the existing three routes to the headquarters at Mammoth Hot Springs were unacceptable and would prove very costly to be rendered serviceable and safe.⁴¹ Thus he cut a new roadway

across countless spurs and gulches along the mountain side midway between them. In this I finally succeeded, and without sharp curvatures, carried a line of easy

grades for some three miles, and with only a moderate amount of bridging, constructed a road much shorter and in all respects superior to what could have ever been made upon either of the other routes at manifold its cost.⁴²

The new route expedited the delivery of construction materials and supplies for the building of the park's first administrative headquarters at Mammoth Hot Springs. By August, Norris left the headquarters (on the road built in 1878 to the geyser basin) with a large crew, animals and three wagons of supplies. Along the way, the crew cleared large quantities of fallen timber on the roads, and repaired and constructed culverts and bridges. Norris supervised improvements and the widening of the grades at Obsidian Cliffs, Norris Plateau, Gibbon Canyon, and down Madison Canyon to the western boundary.

Locating a direct route from the Upper Firehole Geyser Basin to Lake Yellowstone was Norris' next priority and the principal project for the 1879 season. This area baffled many past expeditions, and Norris claimed "from the commencement of explorations within the park . . . it led to greater efforts and more failures than any other trail."⁴³ Norris found evidence of other explorers during his first unsuccessful trek crisscrossing the Continental Divide. On his next attempt, he spent several days of "excessive exposure and hardship, and nights of sleepless cold and anxiety" in tracing a route down the north bank of the Firehole River south to the Continental Divide and over two miles east to Shoshone Lake, then in a zigzag direction to the West Thumb area on Lake Yellowstone. Norris selected six mountaineers to accompany him on a pack trail to open the approximately 22-mile route from the Upper Geyser Basin to Lake Yellowstone. From the West Thumb area, he followed the shoreline, opening a trail for approximately 26 miles to the lake outlet. From the outlet, Norris and crew improved the existing trail to Mammoth Hot Springs via the Mud Volcano, Sulphur Mountain, Great Falls and Canyon of the Yellowstone, Mount Washburn, Tower Falls, the Forks of the Yellowstone, and the east canyon of the Gardiner River.⁴⁴

While the road accomplishments seem small, Norris felt that more of the park had been opened to the 1,030 people who visited Yellowstone in 1879. By taking the new route from the Upper Geyser Basin to Lake Yellowstone, tourists could now visit more hot springs and cascades, and by using bridle trails, were able to visit Shoshone, Lewis, and Heart lakes.⁴⁵ Snow cover prevented Norris from completing a trail along the rim of the Yellowstone, which he continued to feel was the "true one" for a wagon road or bridle trail to the eastern spurs of Mount Washburn, instead of over it. He did, however, spend part of

September improving the 35-mile trail from the forks of the Yellowstone to Soda Butte and constructing a new 30-mile trail from Soda Butte, via the Fossil Forest, over Amethyst Mountain to Pelican Creek on Lake Yellowstone.

Norris mentioned no particular or unusual problems in the building of a bridge over the Yellowstone River above the falls. However, spanning the Gibbon, Firehole and Madison rivers, or their creeks and streams proved more interesting.

Norris wrote in his report, "Few of the anomalous features of the LAND OF WONDERS are of greater scientific interest or of more practical value than the placid, uniform water-flow in its hot spring and geyser-fed rivulets and streams." Because these watercourses are generally "broad, shallow, grassy channels, uniformly smooth banks, with a dense growth of short grass and flowers carpeted to the water's brim, . . . with long stretches of flowing grass and occasional hot spring pools in the channels [and] overhanging turfy banks," Norris eliminated the need for some bridges by cutting slopes through the turf, forming good and permanent fords. Instead of a bridge he placed "long, limber poles and foot-logs, only a few inches above the low stage of water."⁴⁶

Norris also improved the quality of the road signs and guide boards. Two years earlier, cloth had been affixed to trees, but by 1879, odd pieces of wood remaining from construction projects were painted white and lettered in black. The signs directed visitors to significant rivers, streams, geysers, etc., in addition to displaying distances to and between various points. The wooden signs were attached to trees, posts, and stones.⁴⁷

Norris' concern for providing visitors with scenic and interesting views along the roads, was also fulfilled with his finding a route around the base of Bunsen Peak. The drive, which connected with the road to the geyser basin from Mammoth Hot Springs, provided the visitor with views overlooking the Gardner Canyon. He felt that the seven miles were worthy of becoming a carriage way. The Bunsen Peak Road thus became the first planned secondary road.⁴⁸ At the end of 1879, there were 234 miles of park roads and trails.⁴⁹

The beginning of the 1880 season witnessed extremely unfavorable weather conditions in which the state of the roads reflected the effects of swollen streams and unusual snow depths in the mountains. Norris asked the Chief Signal Officer in Washington, D.C. to warn the public of these conditions and suggested visitors delay their trips to Yellowstone until late July. In addition to the possible inconveniences to travel, Norris felt

the conditions would generate "much unjust criticism and censure for the park." Norris knew that many of the previous year's visitors were disappointed in the condition of the park's roads and trails. Norris devoted most of the 1880 season to improving existing roads and trails, with some time set aside for new exploration. He explained to the Secretary Schurz that "[Yellowstone] is also one of the largest, most elevated, and mountainous, as well as far the most humid, densely timbered and difficult in which to construct or maintain roads or trails, of all of our great mountain parks." Norris felt the existing roads were passable, but certainly not ready for "heavy broad-track military wagons or mule train."⁵⁰ In further pursuit of his defense, Norris justified his priorities:

I have deemed it more important to construct buildings for defense of the government property from the frequently recurring and ever-threatened Indian raids and to explore the proper routes for permanent use and open all possible . . . than to hazard the loss of government animals, outfit, and probably valuable lives by Indians, for the construction of a few miles of fine coach-road, leaving the remainder of the Park as I found it--mainly an unexplored pathless region of crags, and forests.⁵¹

Shortly after arriving in Yellowstone on 2 July, he met O. J. Salisbury, a partner in Gilmer & Salisbury Company, who requested his assistance in selecting a new coach and mail route connecting the Utah Northern Railway with park headquarters at Mammoth Hot Springs. The existing route along the Madison River, which required much bridging, was impassable for part of the year and was considered dangerous by many.

After two days of exploration, an acceptable route, cutting south from the Madison River at Riverside, was found.⁵² Salisbury left men to construct a mail station at the Riverside cutoff, while he proceeded east to secure his mail contract. Norris, who once considered the mountainous area south of the Madison River inaccessible, was surprised to find "a dry, undulating, but beautifully timbered plateau, allowing a judiciously located line of wagon road with nowhere an elevation much in excess of 1,500 feet above the Forks of the Fire Hole." This route, some six miles shorter than the Madison Canyon route, would be cheaper to construct and maintain and also would open up new observation points for scenic and geologic interests. Traveling through the beautiful pine forests on an August trip to the West Entrance via the new route, Norris commented that this dry route was preferable to the often snow-covered and flooded canyon route. He felt that this would be the preferred route; however, the

other--if necessary--could be used for part of the summer.⁵³

The remainder of the season was spent exploring a new and shorter route from Mammoth Hot Springs to the Grand Canyon of the Yellowstone, the Yellowstone Lake area, and the fascinating Hoodoos in the eastern section of the park, as well as working on the Gardner River road. Bridges were constructed on branches of the Gardner and Gibbon rivers, across Tower Creek, Cascade, and other creeks near the Great Falls of the Yellowstone. Near Yellowstone Lake, Norris examined the Natural Bridge and determined that the 10' stone structure could be used as a carriageway by the "thousands of eager pilgrims to this wonderland."⁵⁴ Use of the Natural Bridge would divert the route away from the undesirable sand spits, gullies, and other wet areas near Bridge Bay.

Necessary construction and improvements to the West Entrance road and the Fire Hole road delayed Norris' desire to construct a needed route from the Upper Geyser Basin area, via Shoshone Lake and on to the foot of the Yellowstone, via Marys Lake and on to the East Fork of the Fire Hole River. However, Norris made improvements to the Fire Hole River road, opening a new route to meet the old road along the Gibbon River, bridging the Norris Fork and other branches. Costly long causeways, turnpikes and grades along the stretch had to be built, as well as the segments along Obsidian Creek and Gibbon River. An extension of the road to the Forks of the Gardner River was completed, including a road up "through the eastern branch nearly halfway through its terrible canon, necessitating a grade of over 1,000' within two miles."⁵⁵

Toll bridges within the park continued to be a pressing problem. In late 1879, James Demings and George Huston requested permission to build a bridge on the Clarks Fork Mines route. In a letter to Congressman Martin Maginiss, the two Montanans stated that this would enable tourists to visit the mining area and would offer them the opportunity to see "fine hunting country," which could not be seen in Yellowstone. Representative Maginiss reported to Secretary Schurz that the Baronett Bridge was unsafe and in a state of decay and that these two Montanans were "good men, personally known to me."⁵⁶ Shortly after the first of the year, correspondence continued regarding the request for a bridge, but no action took place during 1880. Norris also received a proposal from John Ponsford of Bozeman offering the Baronett Bridge for sale. He requested an inspection of the bridge and a report on its value. Again no action was taken.⁵⁷ In Norris' report to Secretary Schurz, he reiterated his position that "all roads previously made within the park or public lands

of the Nation shall remain free from toll."⁵⁸

Norris felt that his 1879 sign program had been a success with the travelers, but he recognized that vandalism by "a small despicable class of prowlers" had prevented travelers from following the roads and trails and deprived them of the information regarding specific scientific interests. In addition to sign vandalism, these people were "kindling devastating fires, slaughtering game, despoiling geysers and other interesting formations," and robbing tourists. These actions prompted Norris to press for a "speedy enactment of laws to properly protect the park, its contents, officers, and visitors, and the enforcement of the same by a body of determined police." Nature also took its toll, as forest fires and the effects of chemical action, hot water and steam destroyed the wooden signs. Knowing that stone would probably crumble and oxidization and corrosion would probably affect ordinary iron, Norris was faced with the problem of providing a permanent type of sign or guide-post.⁵⁹

In contrast to 1880, the 1881 season opened with favorable weather conditions. In fact, good weather prevailed during the early spring, but Norris was unable to take advantage of it since his funding was not available until 1 July. Nevertheless, in late June, he began to select crews and assemble necessary tools and equipment to begin work on the Fire Hole route and the Yellowstone route on the morning of 1 July. Because Norris was particularly interested in scientific phenomena and the prehistoric and historic Indian occupations of the park, he promulgated the following rules for his road crews:

While labor in the construction of roads and bridle-paths will be our main object, still, with trifling care and effort, much valuable knowledge may be obtained of the regions visited, especially by the hunters and scouts, all of which, including the discovery of mountain passes, geysers, and other hot springs, falls, and fossil forests, are to promptly be reported to the leader of each party. As all civilized nations are now actively pushing explorations and researches for evidences of pre-historic peoples, careful scrutiny is required of all material handled in excavations; and all arrow, spear, or lance heads, stone axes and knives, or other weapons, utensils or ornaments; in short, all such objects of interest are to be regularly retained and turned over daily to the officer in charge of each party for transmittal to the National Museum in Washington.⁶⁰

Norris was in sympathy with Wyoming Territory citizens and

officials in their request for the construction of a route into the park, since most of the park lay within Wyoming Territory. More exploration parties searched for possible wagon routes into the park from points to the east and southeast. Plans for work within the park kept Norris busy for most of the season. Norris pursued the earlier plan for construction of a route connecting Mammoth Hot Springs with the west entrance, via the Forks, Great Falls, Lake Yellowstone, and the Forks of the Fire Hole. A heavy push was made to work on the canyon of the East Gardner. Even though the appropriation scheduling forced him to begin this project after 1 July, he was fortunate in having experienced laborers and a dependable assistant. Faced with the difficulties of both climatic and environmental conditions, a veteran crew was invaluable. In addition to completing the circuit route from Mammoth Hot Springs to the West Entrance, this section of road was needed to transport a portable steam sawmill to supply lumber for constructing bridges, a steamboat for Lake Yellowstone, and two hotels, one at the foot of Lake Yellowstone and the other at the falls of Yellowstone River.⁶¹

Road crews altered the 1880 approach route to the Natural Bridge, affording the visitors observation points and the opportunity to see the natural feature before crossing it. Concerned about a general conflagration, Norris resisted the burning of fallen timber to shorten the route to the thumb of the lake.⁶²

At year's end, an aggregate of 54 miles of road had been constructed: four miles from Sage Creek by Sulphur Mountain to the mouth of Alum Creek; 30 miles from the forks of the Fire Hole River to the foot of Lake Yellowstone, via the East Fork, Marys Lake, and Mud Geyser; and 20 miles along the Gardiner River, from near its bridges to Tower Falls, via East Fork Canyon, Dry Canyon and the forks of the Yellowstone. Sixty-five miles of bridle paths were opened:

11 miles to Paint Pot, 22 miles to Passamaria, 3 miles to Painted Cliffs, and 29 miles to the Hoodoos or Goblin Land. Nine miles of trails were constructed: seven to Terrace Mountain, one to East Gardiner Falls, and one to Monument Geyser Basin. At least twelve bridges and four footbridges were built in 1881.⁶³

Norris, in his 1881 report to Secretary of the Interior Samuel J. Kirkwood, recommended additional bridge and road construction and also repeated the need to settle the private holdings situation. In October of 1881, C. J. Baronett sought permission to either retain his toll bridge and collect fees, or sell the bridge to the government.⁶⁴ The position of a reliable bridge over the Yellowstone River near the Baronett Bridge was crucial to any further development of routes to the Hoodoos or Goblin Land, the pass to Pelican Creek and Lake Yellowstone, and to the Clarks Fork mines. Norris, anxious to complete the

circuit from Mammoth Hot Springs to the West Entrance, knew that the remaining approximately 20 miles between Tower Falls and the terminus of the other end of the road near the mouth of Alum Creek, would be a costly project. Despite much of the stretch being a natural roadway, the abysmal Tower Creek canyon, the ascent of Mount Washburn via Rowland's Pass, the extensive need of rock work, culverts, and timber cutting, grading, and bridging along the route led Norris to calculate the need for an additional \$10,000 over the regular annual appropriation to cover the cost of the road. The amount would not allow for any other construction projects elsewhere in the park.⁶⁵

Concluding remarks in his annual report for 1881, which was to be his final report, indicated that Norris could visualize a time when appropriations for the construction of roads, bridle paths, and trails, would not be perpetual. While his prophecy proved to be incorrect, Norris is credited with providing more than two-thirds of the existing circuit, or Grand Loop system. He was responsible for the construction of 104 miles of the 140-mile system.⁶⁶

Patrick H. Conger of Iowa replaced Philetus Norris as Superintendent, serving from 1 March 1882, until 9 September 1884. His tenure, characterized as weak and inefficient, "brought the Park to the lowest ebb of its fortunes, and drew forth the severe condemnation of visitors and public officials alike."⁶⁷ Nevertheless, the Conger period is important in park history, for it precipitated needed reforms. Conger accomplished little in new road construction. His efforts were mainly in the improvement of existing roads, including the old Madison River route, which Norris bypassed after he constructed the road over the Madison Plateau.⁶⁸

Conger constructed a three-mile section of road along the bank of the Yellowstone River near the falls and canyon. Finding the construction costly, just as Norris had predicted, Conger provided the tourists with safer and more comfortable access to the wonders. Another of Conger's accomplishments was the summer headquarters. Built near the Fire Hole Basin, it provided convenient and commodious housing for road crews in the vicinity.⁶⁹

During 1882, a substantial bridge over the Gardiner River, some twelve miles from Mammoth Hot Springs, was built in two weeks. The bridge had abutments built well out into the river on both sides. The center pier and the abutments were constructed of log in a V-shaped configuration, pinned at the corners, and filled with rock above the high water mark. The 96' bridge was covered with hewn logs 5" thick. Conger supervised the construction of

additional footbridges and rebuilt a bridge over the Gardiner that had been destroyed by a large fire near Mammoth Hot Springs.⁷⁰

In 1883, a large hotel opened at Mammoth Hot Springs and the Northern Pacific Railroad built a branch line from Livingston, Montana, through the valley of the Yellowstone to a point within eight miles of park headquarters at the springs. Stage service was offered from the train station to the park. The improved accessibility of the park was concurrent with management and supervision of road and bridge construction being turned over to the United States Army Corps of Engineers under the Secretary of War.

CHAPTER II

THE GENESIS OF NATIONAL PARK ROAD STANDARDS 1883-1890

The region embraced in the national park from its high rugged and mountainous character, presents in varied forms and combinations almost every obstacle that nature ever offered to the construction and maintenance of roads. There are steep mountains and dense forest, rocks, streams, canons, and marshes, a moist climate, and heavy snows, besides the peculiar hot spring formations which are very extensive and afford the worst road material I ever met with.

--1st Lt. Dan Kingman, U. S. Army Corps of Engineers

As a result of depredations on the natural features, the wanton killing of game and poor administration in general, members of Congress and interested citizens requested that the administration of the park be turned over to the military. On 3 March 1883, just 11 years and two days after the creation of Yellowstone National Park, the first phase of military presence began in the Nation's first park. The Army Corps of Engineers arrived to take charge of the construction and improvements to the park's road system. Three years later, the U. S. Cavalry would join the Engineers and assume the role of administering the park. The Sundry Civil Appropriation Act allowed \$40,000 for the protection, preservation, and improvements of the park, of which \$29,000 would be used for the improvement and construction of roads and bridle trails. The balance of \$11,000 would cover fixed salaries as established by the act. The superintendent was to receive \$2,000, and each of his ten assistants was to receive \$900.⁷¹

On 13 August 1883, 1st Lt. Dan C. Kingman, U.S. Army Corps of Engineers, escorted by a sergeant and ten privates of the 6th Infantry, arrived at the Mammoth Hot Springs headquarters. The party, which departed Omaha, Nebraska, by rail on 28 July, came by pack horse from Beaver Canyon, Idaho, over the Targhee Pass and down the Madison Valley. Ironically, Lieutenant Kingman's commanding officer of the Department of the Platte, Maj., Gen. O. O. Howard, was the same officer who had pursued the Nez Perce Indians through the park in 1877 and had been credited with some of the initial road work over the Mary Mountain route.

Kingman, a future Chief Engineer of the U.S. Army, described the conditions of the park roads as "very bad, barely passable even

in good weather" and the bridges were "covered with small poles, and then even long stretches of corduroy to weary and vex the people who were obliged to travel over them."⁷² He found the bridle paths were passable by horseback.

The Army officer did not blame the road conditions on his predecessors, but used the limited appropriations as an excuse. However, it became evident that during the first decade of the park, where roads were concerned, quantity not quality had been the order of the day. The existing 160 miles of roads enabled the tourists to visit the main points of interest, but as a result of minimal funding and engineering experience, the roads tended to be very hilly, crooked, and cluttered with tree stumps. Trees had been cleared only enough to provide the passage of a single wagon. Improper drainage systems often left water in the middle of the road. Kingman found the sidehill cuttings "temporary in character" and generally "supported on the outside by logs and brush."⁷³

Since the park was well into its tourist season, Kingman's immediate plans were to repair the existing roads and not construct new ones. Superintendent Conger provided Kingman with enough supplies and horse teams for fifteen to twenty men. The shortness of the time available prevented any contract work during 1883 and only day labor was employed. Kingman was surprised to find sufficient numbers of men of "ordinary intelligence, but somewhat fickle and restless." Thus, he quickly was able to assemble more parties, each under the supervision of a foreman.⁷⁴

Lieutenant Kingman purchased a 30hp portable steam sawmill with a 58" saw. The sawmill, delivered by railroad to the end of the Northern Pacific branch at Cinnabar, was positioned near Mammoth Hot Springs. Kingman's crews used burned trees from the 1882 fire in the Mammoth area. Determining the trees were still usable for timber for bridges and culverts, he had the crews cut 3" planks and dimensional lumber before worms or decay set in.

Before 1883 ended, Kingman had made progress on road repairs, but more importantly, he developed a philosophy of landscape values, which many years later would be expressed by the National Park Service's Division of Landscape Engineering (and its successors). Recognizing the difficulties, and in some cases, what seemed to be insurmountable problems, Kingman recommended to the Secretary of War and to the Secretary of the Interior that only good roads be built in the Yellowstone. He felt that they should "have something of the solid, durable and substantial quality that usually characterized the works constructed by the national government."⁷⁵

In establishing the first park road standards Kingman recommended an

18 feet width road, well rounded up in the center, and provided with suitable side ditches and cross culverts; that all trees be removed for a width of 30 feet; that on side hill cuttings the fill be retained by a dry stone wall, and that an ample ditch be placed on the up hill side at least a rod from the road to catch the snow water and convey it to the natural water courses, and that where there are meadows or marshes that cannot be drained and must be crossed, the corduroy be replaced by a good plank road. That all culverts be of stone or 3 inch plank, and that all bridges be well constructed of good sawed lumber.⁷⁶

Kingman expressed further concern for the appearance and quality of the park:

. . . if it ever becomes the resort of fashion, if its forests are stripped to rear mammoth hotels, if the race course, the drinking saloon and gambling table invade it; if its vallies [sic] are scarred by rail-roads, and its hills pierced by tunnels, if its purity and quiet are destroyed and broken by the noise and smoke of the locomotive, if in short a sort of Coney Island is established there, then it will cease to belong to the whole people and will be unworthy of the care and protection of the national government.⁷⁷

From August 1883 to the end of the construction season, Kingman's crews repaired existing roads. Finding the most heavily traveled road, from Mammoth Hot Springs to the Firehole Basin, in the worst condition, the largest work crews reported there until heavy snows of 18"-30" inches during the middle of October prevented continuing. This forty-mile stretch, with the exception of a three-mile portion in the Gibbon Canyon, was widened, straightened, stones and stumps removed, and slopes reduced. Frequently spaced turnouts and a new ford were built. The existing bridges were repaired and the corduroy sections were covered with sod and earth. Work on this segment cost approximately \$6,300 or \$170 per mile.

The work on the four-mile section of road between Gardiner and Mammoth Hot Springs cost approximately \$50 or \$12.50 per mile. The crews only filled the ruts and removed stumps from this

section. Kingman decided that the north entrance route, which was the most heavily used, was hampered by a steep hill that had to be negotiated before arriving on the plateau at Mammoth Hot Springs. The existing road had steep inclines, which often made it impossible for wagons to ascend in wet weather. Kingman recommended abandoning the route and replacing it with a new one following the West Fork of the Gardiner River and joining the old road about four miles from the starting point.

Kingman knew that this route, with its exceptional obstacles, would be expensive to construct, estimating it would cost approximately \$2,000 per mile, more than double what it would cost in other areas of the park. During 1883, he spent \$5,740 and estimated an additional \$3,000 would be needed to complete the eleven-mile section. Before the crews stopped for the winter, an excellent road had been constructed up to the point of the rock work. Kingman hoped to complete the entire project before the first visitors arrived the following spring.⁷⁸

Between the Firehole and the Upper Geyser Basin, a ten-mile road section, Kingman built a new bridge across the West Fork of the Firehole River and several smaller bridges. Stretches of corduroy sections were repaired and ruts were filled in, all for the sum of about \$850 or \$85 per mile. From the Firehole River to Yellowstone Falls, small bridges and corduroy sections were repaired and the general maintenance of removing stumps, trees, and rocks was accomplished for approximately \$75 per mile for the 28 miles. Culvert and ditch repair was completed on the Clarks Fork road for about \$12.⁷⁹

At the end of his first year, Lieutenant Kingman sent a request for an appropriation of \$110,000 for the fiscal year 30 June 30 1884 to 30 June 1885.⁸⁰ Kingman recognized that in selected portions of Yellowstone, the existing roads would be relocated and/or abandoned. He urged an additional sum to purchase the Baronett Bridge, as he agreed with the previous superintendents that toll bridges should not be allowed in a national park.

Kingman felt that miners in the Clarks Fork mining area could hardly be asked to improve the road to the eastern boundary, since it was entirely within the park. Nevertheless, the miners received all their mail, supplies, machinery and tools over this route. Therefore, Kingman sought additional funds to improve the bad road from Yancey's to the east boundary near Cooke City.⁸¹

While Rufus Hatch, president of Yellowstone Park Improvement Company, concurred with Lieutenant Kingman on the condition of the roads in 1883, he noted "The conveyance of Tourists by stage

coach through the park was conducted without a single accident, notwithstanding the rugged and in many places dangerous character of the Roads."⁸² In Hatch's letter to Secretary of the Interior Henry M. Teller, he urged a "sufficient appropriation" for the roads as the visitors who made the long journey to park should not be deprived of visits to the places of interest because of the roads. He announced the company would upgrade the stage and saddle horse service in the park; he hoped the roads would also be improved.⁸³

Lieutenant Kingman remained popular with the civilian superintendents, and in December 1885, Superintendent D. W. Wear wrote Secretary of the Interior Lucius Lamar requesting that Kingman be permanently assigned to Yellowstone National Park.⁸⁴ Kingman was steadily making progress with the construction of new roads and bridges and the improvement of the older roads. Since the fall of 1883 and prior to the beginning of the construction season of 1885, Kingman had used 200,000 feet of lumber in bridge construction.⁸⁵

Three routes, the Mammoth Hot Springs to Gardiner, via the West Fork of the Gardiner River, Norris Geyser Basin northwards toward Beaver Lake, and the Upper Firehole River to the Upper Geyser Basin, received most of the attention in 1885. Several major bridges were completed, one over the Gardiner River at the ford, one over the Gibbon River at the lower ford, and one over the Gibbon River at the third crossing.

The 4 1/2-mile Mammoth Hot Springs to Gardiner road, via Golden Gate and the West Fork of the Gardiner River, was completed in June 1885. Even though started in September 1883, construction took only seven months. Some 1,275 pounds of explosives were used and more than 1,300 shots in drilled holes were fired. As a result, 14,000 cubic yards of solid rock were excavated in addition to a large amount of broken and crushed stone. This dangerous section of road was completed without any loss of life or injury. Completion of this segment reduced the route by 1 1/3 miles and travel time to many areas in the park from two hours to half a day depending on the type of wagon and load. The reduced 250' ascent to Swan Lake plateau enabled loaded wagons traveling in opposite directions to pass with relative ease. The near vertical stone walls of the canyon prevented excavation of a roadway, so a 228' wooden trestle was employed to carry the road. Lieutenant Kingman noted in his report for 1885 that the "natural stone monument at the end of the trestle" marked what "visitors have called the Golden Gate."⁸⁶

In the Firehole River to Upper Geyser Basin route, Kingman constructed a new road, as the old, poorly located road would be

very costly to improve. The "unnecessarily long" old road crossed a "kind of geyser swamp" in some places and soils of a "black obsidian sand" in others.⁸⁷ As the road neared the Upper Geyser Basin, the alignments of the old and new roads were almost the same. The new route, which cost a total of \$6,042.53, reduced the three to four hours travel time from the Marshall Hotel at the Forks of the Firehole River to the Upper Geyser Basin to one hour. Kingman described it as "well built" and said that the bridges and culverts had "substantial character." He further described it as "sensibly level, and as the roadbed is mostly composed of gravel that packs well, it is a very pleasant road to drive over."⁸⁸

The first trestle bridge built in the park crossed the Firehole River above Hell's Half Acre. Kingman felt that this structure was well suited to the unusual conditions of the locality, as the "enormous quantity of hot water that this river received [means] it never carried any ice, and as its discharge is remarkably uniform (there is hardly a difference of a foot between high and low water) it bears little or no drift wood." The 100' trestle bridge, which cost \$400, was covered with 4" hewn planks.⁸⁹

Kingman established a road camp near the Norris Geyser Basin in order to begin work on the new road between the basin and Beaver Lake, where it would connect with the old road at the head of the lake. The poorly-located old road ran in an easterly direction south of Beaver Lake before entering the woods near Lake of the Woods, then climbed steep Green Creek Hill, crossing the Continental Divide at the junction of the rivers near Norris. Due to excessive snow depths and heavy timber covering, the road was concealed well into May. The poor subsurface drainage caused by the heavy clay soils and the "saucer-like shape" of the pass produced "horrible conditions" for travelers. Kingman noted that it was not uncommon "to see a team lying in the mud, tangled in their harness and floundering about in almost in unextricable [sic] confusion while the drivers looked on in despair."⁹⁰ Consequently, Kingman sought a new route that would provide more exposure to the sun, better drainage, and better soil conditions. The seven miles of new road, completed by the middle of October, cost \$6269.80.

Before the close of the 1885 season, the crews replaced "a long and rather unsafe structure built of poles" with a "single span

King-post truss of 30-feet" combined with a causeway, over the Gibbon River near the Norris Geyser Basin.⁹¹

In his final report for 1885, Kingman concluded that the use of day labor and the government's purchase of supplies was preferable to and more economical than hiring a contractor. On 23 October, Kingman left the construction and road responsibilities to a hired watchman. The watchman's primary duty was to inspect the Mammoth Hot Springs to Gardiner road, making sure it remained open for travel over the winter. Only once during the winter of 1885-1886 did he have a closure. A small landslide, which obstructed travel for a short period, had to be cleared by hired laborers at a cost of \$15.39.⁹²

In Lieutenant Kingman's proposals and request for appropriations for the next season's work, he added a new category, the maintenance of existing roads. With the completion of thirty miles of new road added to approximately thirty miles more of road that was "good naturally," he intended to set up a new organization of road section crews. These crews, under the supervision of "competent roadmasters," would each be responsible for an eight or ten-mile section. Their duties would be to keep the roads clear of stones, keep the surface smooth, keep the ditches and culverts open, and try to prevent ruts from forming. Kingman felt this would maintain the roads in acceptable condition at a minimum cost.⁹³

In order for Kingman's new maintenance function to succeed, rules and regulations needed to be imposed regarding the different types of vehicles using the park. In addition to the coaches and carriages used for touring parties, many different types and sizes of wagons traveled on the park roads. Kingman's major concern was the damage caused by the different sizes of tires and heavy loads.⁹⁴ In May 1886, an order was issued requiring all wagons hauling heavy freight over the park roads to have a minimum of four-inch tires.⁹⁵ While this order caused some inconvenience to the major concessioner, the Yellowstone Park Association, the president, Charles Gibson, wrote to the commanding officer, Capt. Moses Harris that "Individually I approve of the wide tire order."⁹⁶

Once again, \$5,000 for the purchase of the Baronett Bridge over the Yellowstone was requested. Although Kingman used the amount that previous superintendents had suggested, he believed it exceeded the bridge's worth, having made comparisons of the costs of recently constructed spans. He reported that another privately built bridge had been constructed over the East Fork of the Yellowstone during the winter of 1884-1885. Even though this unsightly and unsafe span was not a toll bridge, it should not

have been built without the permission and supervision of the engineers working in the park.

Kingman had more than a personal interest in the park's welfare. He recognized the role that Yellowstone had for scientists, as well as for travelers.

I talked with none among the thousands who visited it, who did not appreciate the wisdom that dedicated the National Park to its present uses, or who doubted that the Park was destined for a great and valuable future. It is not too much to say that if the Park can be preserved as it now is, subject only to such slight changes as are necessary to secure good roads and trails through it, and proper hotels to insure the comfort of visitors, it will become in time a health and pleasure resort unequalled in the whole world. Its maintenance is of more than national importance, it is an object of direct personal interest, now and in the time to come--to travelers and scientists the world over.⁹⁷

Capt. Clinton Sears, who replaced Kingman as officer in charge of construction of roads and bridges in May 1887, reported that heavy snows over the winter of 1886-87 had left the roads in poor condition, but by 20 June they were in good shape. The high spring runoff caused damage to some bridges and washed out some roads. Changes to the Gardiner River's main channel undermined the south abutment pier of the main bridge, but E. J. Lamartine, the overseer, built a brush and gravel dam and revetment to steer the water into the old channel. The road near the lower Gardiner Bridge had to be cleared of debris, the road crowned, retaining walls rebuilt, and the bridge replanked. The wooden trestle through the Golden Gate was strengthened by the placement of new timber supports and road-bearing cross beams. A log and pole temporary bridge was placed over Obsidian Creek at the ford due to the unusually high waters.

In 1887, Sears proposed to complete the twelve miles of road between Norris Basin and the Grand Canyon of the Yellowstone, build a new seven-mile road from Swan Lake Flats to Beaver Lake, build a new road between Norris Basin and Gibbon Canyon, which would complete the six-mile gap, and build a new road of approximately ten miles between Gibbon Canyon and the Firehole Basin. Captain Sears adhered to Kingman's philosophy of building "thoroughly good roads and bridges, . . . rather than to attempt to secure a greater mileage of inferior roads. . . . The National Park is a great national trust, which should be carefully guarded and preserved, while, at the same time, made readily, safely, and

cheaply accessible throughout its extent."⁹⁸

The principal roads in the park in 1887 were described as:

1. A road from the town of Gardiner, on the northern border of the Park, to the Upper Geyser Basin, a distance of about 50 miles. The graded portions of this road are in extent as follows: From Gardiner, via Mammoth Hot Springs, to near Swan Lake, about 10 miles. From Willow Park to the Norris Geyser Basin about 10 miles. From Gibbon Meadows to the head of Gibbon Cañon about 6 miles. From the Lower Geyser Basin to the Upper Geyser Basin, 9 3/4 miles. The portion of this road not yet graded is in fair condition and perfectly safe for travel, a considerable amount of labor having been expended upon it yearly for repairs.
2. A road from the Norris Geyser Basin via the Grand Cañon and Falls of the Yellowstone to Lake Outlet, about 27 miles. This road is graded for a distance of about 8 miles from the Norris Basin. The remainder of the road is in fair condition at this date. The portion of the road between the Falls and the lake is not ordinarily in condition for travel before about the middle of July, the altitude being such as to prevent the early melting of the snow.
3. A road diverging from the road to the Lake in Hayden Valley, about 8 miles from the Falls and extending to the Lower Geyser Basin, via Mary's Lake and Nez Perce Creek. The distance from the Falls of the Yellowstone to the Lower Geyser Basin by this route is about 32 miles. The road is ungraded, but in fair condition, being an excellent natural road with the exception of a somewhat precipitous descent from the plateau between the waters of the Madison and Yellowstone, on its western slope. This road from its altitude is seldom open for travel before the middle of July.
4. A road from the Lower Geyser Basin to the western border of the Park about 20 miles. This road extends beyond the Park limits to Beaver Cañon Station, a stage line from that point bringing visitors to the Park at the Lower Geyser Basin. This is a fair mountain road and safe for travel.
5. A road diverging from the main Park road near

Mammoth Hot Springs and extending via the canon[sic] of the East Gardner River, Baronett's Bridge, and Soda Creek, to the northeastern corner of the Park, about 55 miles, and to Cooke City, some 5 miles farther on. This road, over which all supplies for the mining camp of Cooke City are freighted, is through a rough and hilly country and throughout the greater portion of its extent is unimproved. Some slight grades have been made where it was absolutely necessary, and a few crude bridges constructed. The road has been chiefly built and kept in repair by private enterprise and is by far the worst road in the Park, being well nigh impassable a large portion of the year. Toll is very properly charged at Baronett's Bridge, as it could not otherwise be kept in repair by private means. The bridge across the Lamar River is in a very dilapidated condition and will probably not last more than a year or two longer. It would seem to be eminently proper that this road, within the Park limits, should be taken in charge by the Government, the Baronett's Bridge claim extinguished, and the road kept in proper and safe condition for travel.⁹⁹

Sears, who was replaced by Maj. Charles J. Allen in April 1888, proposed an ambitious schedule for that year, including construction of a new road from the Upper Geyser Basin to the mouth of the Yellowstone, improvements to the 14-mile segment between Lake Yellowstone and the Grand Canyon, a new 20-mile road from the canyon to Yancey's, and improvements to the existing 18-mile track between Yancey's and Mammoth.¹⁰⁰ Due to lack of sufficient appropriations, little was accomplished. However, a new five-mile road was built from the Norris Hotel across the Gibbon Meadows connecting with the road into Gibbon Canyon, a seven-mile stretch from Obsidian Cliff northward, and the Norris Basin to Grand Canyon road was finished.¹⁰¹

The mild winter of 1888-89 and the early spring weather enabled road crews to begin improvement work about the middle of March in the Mammoth Hot Springs area and out in the park by 15 April. Lt. William E. Craighill resumed command of the road construction and improvement work in the park in April. Using part of \$25,000 appropriated in October 1888, Craighill purchased a 12hp portable Nagle engine and a Brownell pony sawmill for \$1,267.82. The equipment was delivered by rail to Cinnabar. The portability of the equipment reduced the cost of sawing the lumber for bridges and culverts.

By 1889, twenty-one bridges had been built, including four which

were considered substantial and which would meet the needs for a number of years to come. However, Lieutenant Craighill felt that eventually, as appropriations warranted, they should all be replaced with iron or stone structures.

A king and queen post truss with a through span of 40' was built over the Gardner River at the south end of Swan Lake Flats. It had a trestle span of 20', a roadway width of 14', and a height above low water of 6'6". An 86' trestle with a 13'8" width roadway between guard rails, and standing 5'6" above low water, was built over the Gibbon River in the canyon. The engineers felt that a trestle could be safely built there because the river, which has many hot springs in its bed, would not experience ice build up. A 115' trestle, with a 14' wide roadway and 30' height above low water at the middle point, was built over a stream near Yellowstone Falls. Another bridge was built near Yellowstone Falls over Cascade Creek. This was a king and queen post truss with a trestle approach of 30'. The span of the truss was 40' and the structure stood 20' above low water.¹⁰²

By October 1889, sixteen miles of new road had been built: between the Gardner River and Mammoth Hot Springs Hotel--.8 mile; in Swan Lake Flats--.9 mile; in Gibbon Canyon--2.7 miles; at the Grand Canyon--1.2 miles; on the Firehole River above the Upper Geyser Basin--3.5 miles; and on the shore of Lake Yellowstone--7.4 miles. In the improvement and construction of new roads, a mixture of gravel was added to the dark colored clay, which was found in many locales along the route of the roads. It packed well when moist. As a result of little rainfall during the summer, the roads often had several inches of fine powder or dust, which was a great nuisance to the visitors. Lieutenant Craighill recommended that the roads be covered with broken stones to help alleviate the problem.

Several construction methods changed during 1889. The 18' width remained the standard for level and straight sections of the road. However, widths on sharp curves were increased from 10 to 50 percent to enable the safe passage of vehicles. The sidehill cuts, increased from 2' to 6', allowed room for any accumulation to be trapped on the inner side of the road instead of reducing the width of the roadway. Dry stone walls were laid up steep hillsides. Fortunately, stone of good quality was readily available in most cases. However, Craighill found the stone in the Grand Canyon soft and unworthy as a building material. The engineering officer made an effort not to scar the landscape with unsightly borrow pits or great piles of felled timber. The routine was to burn the piles if the timber could not be disposed of in any other manner.¹⁰³

Most of the 1890 work was in the Gibbon Canyon area and near the hotel at the Grand Canyon of the Yellowstone. Both projects required construction of many retaining walls. Word reached the park in 1890 that any new road work appropriation would have a rider attached that would require the work to be done by contract. The Acting Superintendent, Capt. F. A. Boutelle of the 1st Cavalry, stated in his annual report that "[T]he person who advocated that proviso must have done so very thoughtlessly, or have been ignorant of the situation." With such a short construction season and the nature of the emergency situations due to weather and topography, the use of contractors could delay the opening of the park until July. Captain Boutelle suggested that if this contract procedure should go into effect, a system for the use of day laborers needed to be included.¹⁰⁴

CHAPTER III

THE CHITTENDEN ERA (1891-1905)

The first difficulty arises from the wretched nature of the material through which the roads pass.

Unquestionably there is no other spot of equal area on the face of the earth where there is such a remarkable variety of substances, and such curious combinations, in the composition of the soil . . . He may expect to encounter in any single mile of road construction all the varieties of work which he would find in building a turnpike from Portland in Maine to Portland in Oregon.

-Lt. Hiram Chittenden, U.S. Army Corps of

Engineers, 1894

Lt. Hiram Martin Chittenden, who took over the responsibility for the road improvement and construction from Lt. Craighill in 1891, immediately took up the work being done on the West Thumb and Old Faithful route and on the road from the Grand Canyon to West Thumb via the Lake Hotel area. Capt. George S. Anderson, the acting park superintendent, noted that Chittenden was "zealous, untiring, and remarkably efficient."¹⁰⁵

Because the 1891 appropriation was awarded so late in the year, Chittenden had two years' worth of appropriations totaling \$120,000 to use during the late spring and summer of 1892. All the existing roads were put into good condition, including the 52-mile road from the Grand Canyon to the Upper Geyser Basin via Lake Yellowstone, which opened during fall 1891. The road had not settled properly before the snow fell, and was badly washed out and muddy. While many thought the Canyon to Old Faithful road via Lake was one of the "most picturesque drives in the park," Chittenden urged the rebuilding of one of "the worst, most tedious, and least interesting drives in the park," the road from the Gibbon Falls to the Lower Geyser Basin.¹⁰⁶

In 1892, Capt. Anderson recommended to Secretary of Interior John W. Noble that the road construction appropriation be placed under the control of the park superintendent, a cavalry officer, and not the supervising Army Corps of Engineers officer. In response to this suggestion, lieutenants Chittenden and Scott made light of the proposal:

He who builds a road occupies a peculiar position. Of necessity he is in the eyes and nose and mouth of every one who passes that way. He fills the first with

admiration (or tries to), the second with dust, and the third with a miscellaneous assortment of praise and blame. If there is any one thing that every citizen of the United States feels perfectly competent to do, it is to build a road. And hence, when it catches an engineer--who thinks he alone knows it all--building one, the public takes an inning. This is as it should be. In the present case the officers of one branch of the public service are doing their duty as well as they can, while the public and the officers of coordinate branches sit in judgment and make them smart for every flaw. This also is as it should be. We welcome it and will take our medicine right along. We will cheerfully wear our brothers as a hair shirt and go with our duty. The officers of the Corps of Engineers seek neither place nor duty. They go where put, stay put, and cheerfully perform their duties as put, as best they may. They are neither pinks of perfection nor angels of radiant light. The under-signed makes mistakes, and is glad of it. To err is to be human, to be perfect, a mugwump.¹⁰⁷

Other recommendations by Captain Anderson were for the construction of a road from Cinnabar to Cooke City and from the Upper Basin to the south boundary of the park on the Snake River.¹⁰⁸

Anderson reflected his lack of control over the appropriations in his 1893 annual report, stating "Of the roads I can say little, as I have no voice in their construction or maintenance." However, Anderson kept his admiration for Lt. Chittenden and expressed his unhappiness with Lt. Chittenden's transfer in the early spring of 1893. "The unfortunate relief of Lt. Chittenden last spring has been a most serious blow to road building here," Anderson said, noting, "He [Chittenden] was greatly interested in his work, tireless in his attention to it, and ably equipped for it."¹⁰⁹

Insufficiency of funds and problems with their distribution plagued the road construction projects during 1893 and 1894. By early spring, all of the previous year's monies were exhausted and ongoing repair work was done by the soldiers or by transportation company employees. In 1893, timber clearing was completed on the West Thumb to Lewis Lake road, a new road was laid out and begun along the Gibbon River to avoid the Canyon Creek Hill, work continued on the road that passed near the Upper Falls, and a road near the Grand Canyon at Inspiration Point was opened. During 1894, Anderson reported little work except for the near completion of a bridge over a dry ravine near Canyon.¹¹⁰

Shortly after Anderson submitted his 1894 report, an order came from the Secretary of War advising him of the long-awaited transfer of funds and management to his control. With little time left in the 1894 construction season, crews were able to complete an arch bridge near the Upper Falls, do some repair work, and build a new road between Gardiner and Mammoth Hot Springs, 1 1/2 miles from headquarters. The new route avoided the steep grades of the old road. Activity increased in 1895. Several new roads were completed: one from the brink of the Grand Canyon to Inspiration Point, via a point over the Lower Falls, one from just south of Alum Creek around Sulphur Mountain joining the old road near Antelope Creek, one from Lake Hotel to the Natural Bridge, and one beginning at a point on the old road near Gibbon Canyon south across the flats toward the Firehole and also connecting with the road down the Madison River. A bridge over the Firehole, south of Excelsior Geyser, and a bridge over the Gibbon near the mouth of the canyon at an old ford, were also completed. In Anderson's report, he outlined proposed plans but called upon Secretary of the Interior Michael Hoke Smith to press for more liberal appropriations. Anderson suggested that a sum of \$100,000 per year, for three years, would allow the road system to be brought up to a standard where the travelers would not be bothered by excessive dust or mud and the funds necessary for annual repair and maintenance would be decreased.¹¹¹

Despite a fairly light winter, heavy snow fell throughout the park. The crews spent much time shoveling out the roads and travelers did not reach the Upper Geyser Basin and the Lake area until 20 June. By August, a new road from the last crossing of the Gibbon River and down the Firehole River to Nez Perce Creek had been built. A bridge over the only crossing of the Madison River was built as part of road work toward Riverside. Work continued toward the south entrance, including the construction of a bridge over the lower crossing of the Snake River. By season's close, five miles at the southern end of the project had been graded and were in good condition. Anderson's assessment of the condition of the south, west, and east approach roads was that the south road was open, but needed extensive work; the west road, nearly completed, was in very good condition; and the east road, from Cooke City to Soda Butte, would be graded by the end of the 1896 season. The road from Cooke City into the park, which had suddenly become popular with camping parties entering from Wyoming, was now considered the worst of all.

Road crews spent time reducing the steep grades on many sections of the old road and all nonfunctioning culverts and unsafe bridges were replaced throughout the park. Anderson engaged a Mr. McHenry, chief engineer of the Northern Pacific Railway, to develop plans for an iron bridge across the Yellowstone River

above the Upper Falls. Determined that visitors should be able to view the Grand Canyon from the eastern bank, Anderson decided that if the cost was not excessive, he would order an attractive iron bridge built.¹¹²

In his appeal for sufficient funds, Anderson presented a case comparing Yellowstone with the state of Connecticut. He explained that the \$30,000 appropriation the park had received for the past few years was inadequate for keeping the roads in good repair, for surveying and construction of new roads. He wrote "There is not an impoverished community occupying a similar area within the limits of the United States that does not yearly devote more money to the single work of road repairs." Anderson believed that he could have first-class roads with the expenditure of approximately \$1,000 per mile or \$200,000 for the entire park. Also included in his request for funds was an amount of \$5,000 to settle the longtime claim of "Yellowstone Jack" Baronett for his bridge. A proposal had been made to extract the \$5,000 for the claim from the current funds for park improvement and protection. Anderson replied that acquisition of the decayed structure could never be conceived to be a work of "improvement".¹¹³

Captain Anderson was replaced as acting superintendent in June 1897 by Col. S. B. M. Young of the Third Cavalry. In addition to the task of opening and maintaining the existing roads, platforms or sidings were built for tourists to use to debark coaches or other vehicles at different points of interest on the regularly traveled route. Also, seven new bridges were built,¹¹⁴ new roads were located, and the assistant army engineer and his crew determined the altitude at each milepost over the Continental Divide between Norris and West Thumb, thus completing the marking of all sections of the entire park. Colonel Young shared the opinions of his predecessors, that "the thorough repairs of the main traveled roads being of more importance than the opening of new roads."¹¹⁵

In 1897, the public pushed for a commission to establish new road locations which would insure that they would have access to all of the wonders and grand scenery of the park. The commission, composed of an Army Corps of Engineer officer, a private citizen, and a member of the U. S. Geological Survey, were to advise Colonel Young of their suggestions.¹¹⁶

By the end of 1897, 10,825 tourists had visited the park. Almost half used the transportation concessionaires, half, private conveyances, and 235 people entered by either foot or bicycle. The increasing number of visitors made more demands on the road system, so Young desired "a generous appropriation by Congress"

to maintain the present roads, and hopefully macadamize a major portion, build strong sentiment to protect the roads, and build permanent stone guardrails at dangerous points.¹¹⁷

As usual, inadequate funds were forthcoming and Young, who was transferred before the end of 1897, left a balance of only \$66.01 for his successor, Capt. James B. Erwin of the 4th Cavalry. With this amount, Erwin was faced with keeping the Gardiner to Mammoth Hot Springs road open during the winter, opening and repairing 170 miles of park roads to visitors by June 1, and protecting the game in Yellowstone from poachers throughout the winter months. In his report to the Secretary of the Interior, Erwin appealed for an adequate appropriation:

I have not the data available to make the comparisons but I doubt if there is any road in the country which is traveled so much by the public, demanding a good road, which costs so little per mile. Here is also seen the impossibility of yielding to the demands of the tourists for more new roads leading to places of interest and beauty reached now only by trails, and not to be carried over twice some portions of the route now used. The amount now appropriated is the smallest amount with which the protection and present road condition in the park can be maintained, and if Congress intends to ratify and make good its dedication of the park to the people of the United States as a pleasuring ground for its benefit and enjoyment, it should yield to the demands of the people and make additional appropriation for the construction of new roads, which will add to their pleasure and benefit by opening new and wonderful phenomena and scenery.¹¹⁸

In 1899, the road construction and improvement program responsibilities returned to the Army Corps of Engineers and fortunately under the direction of by then Capt. Hiram Chittenden. After receiving his orders to take charge of the engineering work in Yellowstone, Chittenden immediately used his previous two years' experience in the park to formulate a plan for the completion of the 300-mile road system. His knowledge of past inadequate appropriations and the untimely schedule for distribution of funds prompted him to press for a one-time appropriation of \$300,000, which he felt would be sufficient to complete the park's road system. This project would cover the completion of the Belt Line (Grand Loop), construction of the other needed roads and bridges on the Belt Line and the approaches to the park, a new office, other necessary buildings, construction plant, equipment and supplies, and maintenance and repairs of existing roads for the 1899 season. Chittenden

envisioned the need for two separate types of appropriations, one for construction and one for maintenance.¹¹⁹ Chittenden pointed out that the only time real progress was made on the system was in 1891 when two appropriations for a combined total of \$120,000 were used to construct sixty miles of road.

Despite an organized approach to the road work, Yellowstone received only \$89,465 for 1899 and 1900. For the first time, the appropriation included a qualifying clause which earmarked \$20,000 of the funds for the construction of a road from Lake Yellowstone to the eastern boundary of the forest reserve in the Shoshone Valley. Without receiving his requested appropriation of \$300,000, combined with the addition of fifty miles plus of the new road construction, Chittenden did not complete his ambitious plan for 1899, but he began to tackle major projects. He started the multi-year reconstruction of the Golden Gate viaduct and initiated the location survey and preliminary work on the East Entrance road (Lake Yellowstone to the forest reserve). In addition to these projects, Chittenden purchased various types of construction equipment and vehicles.¹²⁰

At last, in March 1901, Congress made a reasonable appropriation of \$113,000 immediately available to Chittenden. Allowed more flexibility to use the money where needed, Chittenden felt that the he was able to get 20 percent more work done, dollar for dollar. By the end of the year, the engineers had begun a road from near Yancey's to Soda Butte and Tower Falls. Chittenden preferred to call the Soda Butte road (which is part of the Yellowstone River to Cooke City road) a side road and not an approach road, since there were no plans for it to be used as an approach to Yellowstone.¹²¹ The road through the Gardiner Canyon was shifted to the left bank of the river to eliminate a dangerous section. Work continued on the east and south approach roads and construction extended into the Teton Forest Reserve. In addition to general repairs and a few minor projects, Chittenden experimented with the use of sprinkling on a four-mile stretch of road from above Golden Gate to Swan Lake Flats, trying to eliminate the ongoing dust nuisance. Chittenden considered this section as "by far the best in the Park, and it is the only section that can strictly be called a completed road."¹²²

In estimating his funding needs for 1902-03, Captain Chittenden figured \$25,000 for the annual repairs necessary for about 250 miles of road in the park and the forest reserve. He also faced the overwhelming problem of the road's surface and resulting dust and/or mud. Having three years' experience of seeing the impact caused by the increased visitation on the road surfacing and having completed his experiment with sprinkling, Chittenden made this problem a high priority. He felt that the resolution was to

metal the entire roadbed, using crushed rock or another similar material. His goal was to make surfaces so hard that it would be difficult for ruts to form. This method, Chittenden thought, would reduce the maintenance problem by three-quarters and sprinkling the roads would eliminate any remaining dust. The estimated cost for covering the 18' width with an average thickness of 6" of crushed rock or gravel was approximately \$2,000 per mile or \$300,000 total for the necessary principal roads. As an interim measure and a more realistic goal, Captain Chittenden considered finishing only half of the road surface of the most urgent road sections (about sixty miles). For the 1903-04 season, he submitted a request for \$250,000 for road projects.¹²³

While maintenance had been performed on the road system in Yellowstone National Park for a number of years, Captain Chittenden can be attributed with giving it a major place in the budget and in the daily operations of the park. Soon after his return to Yellowstone National Park in 1899, he called for the separation of appropriations into two parts, with one being allocated strictly for maintenance.

In a speech before the International Good Roads Congress in 1901, Chittenden described the unusual conditions of building and maintaining roads in this very diverse area. The physical conditions of Yellowstone presented the engineers with tough challenges:

The torrential waters of the streams and their susceptibility to springtime flooding had to be reckoned with; the climate of the park falls between two extremes, frequent and heavy rain in the spring and later in the summer, lack of rain causes the road surface to completely dry out and then the travelers suffer from excessive dust; the composition of the soils and rocks in the park "present a greater variety, in all probability, than any other region of like extent upon the face of the globe" (it ranges from the granites to the very softest material of the geyser formations). [Chittenden felt that on the whole the material found in the park was "inferior character" for road work]. Most of the rock was of volcanic origin and not hard enough to withstand the wagon wheels, the soft geyser formation material was considered worthless, and the soil found over much of the park, contained crystals of black rock, resembling obsidian, which had no adhesive power and was easily cut through by the wagon wheels.¹²⁴

Chittenden explained that the roads were principally designed for tourist traffic and secondarily, for use in freight haulage. The main Belt Line (Grand Loop) limiting gradient was 8 percent, but on the forest reserve to Lake Yellowstone road, a 10 percent gradient had to be used in places to surmount natural obstacles. A 10 percent gradient was also employed in other areas where light vehicles were mainly used. In order to deal with long ascents and help wagon drivers with the strain of holding brakes on for long periods, level sections were added approximately every half mile. For the most part, curves were designed for more than a 100' radius. However in some cases, the radius had to be 50'. The 18' road width was flanked by 6' ditches or slopes. The normal clearing or right-of-way had been 30'. Chittenden found that in some cases more clearing needed to be done on the south side of east and west routes to allow the sun in to aid in melting the accumulated snow. The ditches proved to be adequate for drainage, and until that point, no blind drains or other methods had been used. In the some cases, Chittenden built stone road beds or used corduroy, which was submerged under water, to prevent decay. Because of the dry period and the dust problem during part of the season, the engineers tried to retain moisture and thus did not like to drain the water from the ground.

Chittenden told the group the road system required an enormous number of culverts. Until this time, most culverts had been built of wood, but he was systematically replacing them with vitrified clay or iron pipe. Wooden bridges with rock-filled wooden abutments and piers were being replaced by steel bridges with solid concrete abutments or tubular piers.

Captain Chittenden pointed out that his most serious and pressing problem was road surfacing and the resultant dust and he explained to the gathering of his plan for coping with it. Reiterating the problems with locally available materials, he cited his plan to macadamize the roads in areas where he found good quality rock or where the hauling distance was not prohibitive. He found that a particular "pinkish" color formation produced an acceptable surfacing material.

In addition to trying to macadamize as much of the system as possible, Chittenden initiated an extensive sprinkling program. Prior to his one-year experiment on the Swan Lake Flats section south of Mammoth Hot Springs, Chittenden investigated the oiling of roads during visits to San Francisco and Bakersfield, California, where this method was considered a complete success. Despite the variables in weather, and soil conditions and the high cost of transportation, Chittenden felt it might be worth a trial. Chittenden envisioned one oiling per season and he

thought that during the wet season, the oil might cause the water to run off the roads, reducing the mud problems.

In his talk, Chittenden explained that the obvious problem of snow was not as great as one would think since the visitor season was quite short, 1 June to 30 September. The main snow-related problem was the spring runoff. In most years, snow on the main circuit melted by 1 June. However, shoveling was resorted to if necessary and the construction of snowsheds was considered for roads kept open during the winter.

Mileposts and information signs, giving travelers information and identifying objects of interest, had been placed on the main roads; but Chittenden felt it was time to "perfect and embellish" the road system. This highly placed priority would "greatly enhance the beauty and value of the roads." The engineer proposed to clear all dead and downed timber for a distance of 100' and to thin living trees to allow grass to grow among them and to encourage game that frequented the area. He planned to rebuild the retaining walls with fine masonry and to position strong guard rails at the most precarious points; slopes and cuts would be thoughtfully aligned, and where possible, small water courses would be carried along the routes. Chittenden felt that, "In these and other ways the roads will themselves be made one of the interesting features of this most interesting region."¹²⁵

In his closing remarks, Captain Chittenden emphasized that the completion of a good road system in the park would probably reduce the ongoing pressures from others to permit railroads or electric railways within the park. The efforts to introduce railroads were usually based upon the complaints of disgruntled travelers. The Army engineer relayed to the group a philosophical goal that guided his plans:

It is not the policy of the Government to permit any undue extension of the road system of the Yellowstone National Park. On the other hand, it is intended to restrict the roads to the absolute necessities of making the more important features accessible. But while it is not proposed to build any roads not actually needed, nor to change in any unnecessary way the original face of the country, it is proposed to make such roads as have to be built as perfect as any mountain roads in the world. . . It is the purpose of the Government to maintain these reservations as far as possible in their original condition, unchanged by the hand of man.¹²⁶

One aspect of maintenance that Chittenden knew needed serious

consideration was supplying and positioning the necessary number of men in appropriate locations for their work. In 1901, the government provided housing and subsistence, for which the workers were paid 40 cents a day. All of the working parties lived in a camp.

During 1902, work continued on previous years' projects, including the Gardiner Canyon road, the east and south approach roads, the Bunsen Peak road, reconstruction of the Golden Gate, and general repairs and maintenance. The tourists and Captain Chittenden considered the 1901 sprinkling experiment successful. Besides a significant reduction in dust, the treatment seemed to discourage the deterioration of the road surface.

The major drawback to the experiment was the poor water supply throughout the park. This resulted in the construction of six large wooden tanks for filling the sprinkler.¹²⁷ Overhead flow was provided into three of the tanks. A platform on the rear of the sprinkler held a two-handled diaphragm force pump. Two men could fill a 750-gallon capacity sprinkler in fifteen minutes. The sprinkler's front axle was built 12" shorter than the rear axle, allowing the machine to double as a road roller. Generally, the sprinklers ran early in the morning and late in the evening. The choice not to apply water during the sunnier, and in many cases, windier part of the day, resulted in a much lower evaporation rate. Chittenden believed that if a unit could cover five miles, the cost for 75 days would be approximately \$125 per mile.¹²⁸

During 1903 and 1904, several of Captain Chittenden's major contributions to Yellowstone National Park were initiated and completed: the Yellowstone River Bridge, the North Entrance Arch, and the Mount Washburn Road. A number of buildings were completed, including the Engineer's Building, a commissary and storehouse, a machine shop with quarters above, two storage sheds, a stable and a bunk house. The stone and concrete Engineers' Office was heated by hot water and wired for telephones and electricity.¹²⁹

Captain Chittenden felt that the heavily traveled and highly visible northern entrance at Gardiner, Montana, deserved an impressive entrance gate. The Northern Pacific Railway's station, designed by Robert Reamer, had been completed adjacent to the boundary on the western edge of Gardiner and a new route into the park was scheduled for construction. Chittenden called Reamer "an architect of great originality and particularly skillful in adapting his work to natural surroundings."¹³⁰ Chittenden felt that with the completion of the new rustic design train station, the timing was right to further improve the north

entrance with a compatible entrance arch. The railway and the wagon roads ended in two loops, with the train station placed in between. One side of the station was used to unload the passengers and the other side, for the conveyance of carriages. On the carriage driveway side, an artificial pond was constructed. Approximately 30' above the train station grounds, Chittenden constructed the entrance arch.

The gate consists of two square stone towers with a batter of one in thirty, the bottom dimension being 13 feet 3 inches square. The clear space between the towers at the ground is 19 feet 8 inches. It is closed over by an arch, the crown of which is 30 feet above the ground. This arch curtain is 5 feet thick and is built up to the same height as the towers. The entire structure is 50 feet high and is capped with a concrete roof, roughly shingled with the chippings from the cut stone used in arch. The character of the masonry is entirely original. It consists of columnar basalt taken from a quarry nearby in approximately hexagonal prisms. Stones have been used just as found with the least possible dressing, retaining their natural weather worn condition. The points of the prisms project beyond the plan of the face, . . . to the whole structure a novel appearance in a masonry work. The two base courses are roughly cut, as, of course, are the stones in both the small and the large arch openings. The cutting of this stone was a very difficult matter, owing to the extremely hard quality of the rock.

The side of the structure which faces the station is ornamented with three tablets. The largest is 3 feet 10 inches by 20 feet 8 inches, and bears the inscription: "FOR THE BENEFIT AND ENJOYMENT OF THE PEOPLE," an extract from the Act creating the Park. The smaller tablet on the left tower is inscribed, "YELLOWSTONE NATIONAL PARK," that on the right, "CREATED BY ACT OF CONGRESS MARCH 1, 1872." These tablets were molded entirely of concrete. The forms for the letters were manufactured by the Stillwater Manufacturing Company of Stillwater, Minnesota, and were cut out in -overs- with great accuracy. They were made so as to give a depressed letter in the concrete and with a triangular cross section so as to be easily removed after the concrete was set. They were nailed upon a suitable frame which was placed in position to close a recess left for the purpose in the masonry. For the larger tablet this space was 18 inches deep,

that is 18 inches from the face back into the wall. The concrete used was in the proportions 1-2-4. A mortar facing was put in at the same time, sufficiently thick to cover the letters. The concrete rested directly upon the masonry below it. As such as the space was filled and before the concrete had set, the course of stones above was laid upon it, so that their weight pressed into the block making it perfectly laid. The forming was held in position by means of rods ---v---ally laid in the wall.

Extending from the center of the arch in both directions for a distance of about 50 feet are two wing walls 12 feet high, terminating in square towers about 14 feet high. From the tower walls, 8 foot high, extend along each branch of the loop to the Park boundary.¹³¹

The corner stone was laid in a ceremony attended by President Theodore Roosevelt on 24 April 1903, and the first visitors passed through the arch on 1 September. A fence was built to protect the newly landscaped pond area from cattle. Grass was sown and shrubbery planted in the entrance gate park, which was irrigated from the Gardiner River. During spring 1904, the pond had was dredged to remove the silt that had poured down from the surrounding hills with the snow runoff. Trees were planted along the new road across from the Gardiner flats.¹³²

During 1903-1904, the road received additional work. Since it was the most heavily traveled, its width was increased to 25' and its gradients reduced to 8 percent. The entire road was surfaced with gravel or macadam. Material taken from the steep bluff, 1/2 mile from the entrance gate, was used to surface the first 2 1/2 miles from Gardiner. All culverts were replaced with vitrified clay pipe or cast iron, and four steel bridges with concrete abutments were built.¹³³

Nine important bridges were constructed in the park during 1903. The most impressive was a Melan arch over the Yellowstone River above the Upper Falls. The steel and concrete bridge was completed with great difficulty, however, Chittenden felt that this location merited an artistic design because of its prominent location in the park. For many years, the idea of a bridge in this location had been contemplated, but lack of funds prevented its construction. Chittenden spent considerable time on the site selection. Not wanting to introduce an artificial structure at the most desirable and obvious site, the brink of the Upper Falls where the gap narrows to 50', Chittenden chose a 120' span between two jutting rocks, about one-half mile above the Upper

Falls at the rapids. Despite the volcanic rhyolite rock being of inferior quality for construction, Chittenden stated, "from the fact that it has resisted for an indefinite geological period the action of the river, it must have considerable stability."¹³⁴

Including the dangerous rapids just below, Chittenden had many obstacles to overcome. One of the most serious was the construction of the formwork and related framing. All of the rough material was cut locally, but the finer lumber came from the Pacific Northwest. A small dynamo, borrowed from the hotel company, was connected to the rock-crusher engine and a temporary plant to provide artificial light, and crews were able to complete the concrete work by working around the clock.¹³⁵

Due to the position the bridge had in the public's eye and its unique difficulties, the owners of the Melan arch patent relinquished all royalty payments. Some of the material for this bridge as well as material for the others built that year came from the American Bridge Company.¹³⁶

Work continued on the Mount Washburn road during 1903, with ten miles of well-graded road being finished. The section of road lying under an overhanging cliff near Tower Falls proved to be a difficult section. Working through the winter, this scenic section was completed. Additional new sections were completed on both sides of Dunraven Pass and a new road replaced a dangerous section near Ox Bow Creek between Tower Falls and Mammoth Hot Springs. The Crescent Hill Canyon road was widened. The sprinkling program expanded to include the road from Gardiner to Norris Junction. Sixteen sprinklers were used on approximately 55 miles of roads.¹³⁷

The following year, 1905, was the last full year that now-Major Hiram Chittenden directed improvements in the park, before he was transferred to Mount Rainier National Park in Washington, to supervise road construction projects there. [See HAER No. WA-35, Mount Rainier Roads and Bridges, for a discussion of this work.] During his last year at Yellowstone, sprinkling was extended to over 100 miles of park roads. Installation of gravity tanks at various locations on the Belt Line reduced the expense of extra labor involved in manual pumping. Many road reconstruction projects were underway--widening, resurfacing, cutting down hills and filling the hollows, and realignments.

One of the most important road projects was completion of the Mount Washburn road between Tower Falls and the Grand Canyon of the Yellowstone. Chittenden found that the presence of solid rock on most sections of the road made construction very difficult and slow. The road's width ranged from 18'-20'. Other

projects involved most of the other sections of the park. Many bridges were built and/or reconstructed during this time. Most existing wooden bridges were redecked.¹³⁸

Prior to his departure for Mount Rainier, Major Chittenden summarized the status of the road system and made recommendations for future work in his report to the Chief Engineer. He stated that all the roads ever proposed had been built, a few roads would need minor realignments, the sprinkling program had been completed to the expected level, the dust problem had been largely resolved. The east and south approach roads would be adequate unless rail facilities were brought closer to the park in those directions. Chittenden felt that Yellowstone had a good road system in spite of the volume of traffic almost doubling since the turn of the century. However, he warned that if traffic increased in like proportions in the near future, "a new situation is created, which must be met in the near future."¹³⁹

His general recommendations included: widening the 180 miles of Belt Line roads to a width of at least 25'; building guard walls where steep sidehill slopes occurred; building the new guard walls in mortar and rebuilding the existing ones in the same manner; clearing dead and downed timber for a width of 100' from the roadway as a precaution against fire and as a scenic improvement; continue replacing wooden bridges with steel or concrete bridges; continue replacing wooden culverts with vitrified clay-pipe culverts; possibly modifying the ditches to meet the requests of the stage companies, who wanted at least one side of the road available for possible meeting of runaway coaches or other needs; bringing the western approach road up to the standard of the Belt Line; and, continuing maintenance and development.

Chittenden warned that the road surfacing problem remained a cause of concern. He explained that in the past four years, nine-tenths of the Belt Line had been surfaced. Machine crushed rock, hand broken stone and gravel were all used. Chittenden recommended the use of crushed rock for both the foundation and the surfacing material, with subdrainage if necessary. He stated that good gravel, also an excellent material, was easier on horses than rock. Major Chittenden estimated that the cost of surfacing and widening the roads, the construction and reconstruction of the guard walls, building and maintaining the side roads, plus 10 percent for contingencies, would total \$2,023,065. Thus far, the average cost per mile in Yellowstone National Park amounted to approximately \$3,000 per mile, compared to the average cost in the eastern United States of \$5,000 to \$8,000 per mile. Chittenden's projected estimate would raise the parkwide average to approximately \$8,700 per mile. He felt that

considering the remoteness of the location, the short construction season, high transportation costs and unusual geological conditions, this higher amount was still reasonable. Major Chittenden believed that the future work, spread over ten years, would result in the park road system rivaling any of the best roads in Europe. He pointed out that as the park grew in importance, demands on the roads would increase. He outlined several specific projects that needed attention:

MAMMOTH HOT SPRINGS to NORRIS--great care should be taken in widening the road through the "Hoodoos" to prevent the destruction of unusual rock formations. "It will be better to let the right of way have an irregular alignment--being narrower in some places than in others--than to sacrifice this peculiar formation in order to get a uniform width throughout. . . .it would be better to require all teams to come to a walk there than to remedy the defect by blasting out those picturesque rocks." Forested areas at Apollinaris Springs, a point 8 1/2 miles from headquarters, Crystal Springs, and at mileposts 13, 14, and 17 miles out should be cut back on the east side about 30' to expose the snow to the sun. However, if these forests contained fine specimens of trees, the stands should be preserved. The Apollinaris Spring, Kepler Cascade, Mud Geyser and other coach-unloading platforms should be rebuilt and extended to a length of 100'.

NORRIS TO FOUNTAIN--the route of the road from Fountain Hotel to Firehole Lake and the Great Fountain Geyser should be changed with great care given in the hot springs vicinity. The wooden bridge at Riverside Geyser should be replaced with an ornamental bridge. The new bridge should be moved downstream a few hundred yards to remove the unnecessary twist in the road.

UPPER BASIN TO THUMB--great care should be given in widening this section of road to prevent ruining the attractive landscape features--the clumps of willow shrubs. "Wherever the openings in the shrubbery permit, the roads should be given extra width, with narrow stretches between the clumps of willows."

LAKE HOTEL TO CANYON--an 18" pipe culvert and an embankment should replace the small bridge over the dry ravine 4 1/2 miles below Lake Hotel. Concrete culverts should replace the bridge over Sulphur Creek and the one over a stream to the south of Otter Creek. Two 18" pipe culverts should replace short bridges on the

sidehill grade above the second milepost from the Grand Canyon. The Alum and Otter creeks bridges should be rebuilt with shorter spans.

CANYON TO TOWER FALLS--earthen embankments and pipe culverts should replace most of the temporary bridges on this route. In some cases, wooden cribs should support the lower side of the embankments. Chittenden believed that these timber cribs when filled with rocks would last for twenty to thirty years. The Major suggested a possible change to the road location from about 1 1/4 miles south of Dunraven Pass to the top of the ridge, where the climb from the hotel at Canyon ends. The original intent was to build on a near level line, however, the surveyor who was told to run a constant grade between the two points, became leery after seeing that a swampy area lay in his path. Without permission he ran the line above the swamp resulting in a rise and fall of 70' on the line. Chittenden did not feel that the difference was that great but, he wrote ". . . nevertheless, the location is not what was intended and not what it ought to be."

TOWER FALLS TO MAMMOTH HOT SPRINGS--if the maintenance to the existing road, which he felt should never have been built in 1898, became excessive due to landslides, a lower route should be constructed.

NORRIS TO CANYON--Chittenden felt that this, the route of worst road in the park had been ill chosen. However, consideration of the amount of work that had gone into it, and the "fixed termini" discouraged the planning of a new route. Almost the entire route was on native rock; it's character was such that it disintegrated quickly. He felt that the repeated ups and downs gave the road an unattractive appearance. Although the steep grades on Blanding Hill and a steep hill on the slope next to the Grand Canyon had been reduced, he called for the remaining hills and hollows to be evened.

SOUTHERN APPROACH--Chittenden recommended that instead of the road terminating at the mouth of the Buffalo Fork in Snake River, a road should be built at the foot of Jackson Lake then over the Teton Pass to the forest reserve boundary. This would give access to southeastern Idaho.

WESTERN APPROACH--due to the proposed construction of a

new railroad station and the proposed hotel to be built at Riverside, a short section of road had to be relocated. Chittenden suggested that "While the ground would probably admit a single tangent over the entire relocation, it is recommended that whoever lays out the road adopt a sinuous line, so as to shorten the view ahead and enhance the interest to travelers."¹⁴⁰

Major Chittenden believed that the sprinkling program served three important purposes. The primary purpose was to the eliminate the dust problem; secondly, the sprinkling aided in the maintenance of the roads, as prolonged droughts caused rapid deterioration of the surfaces; and, since most of the manmade fires were in close vicinity of the roads, repeated passing of sprinkling wagons assisted in spotting the fires soon after their inception.

The major proposed construction of road camps for crews of thirteen to fifteen men including a cook. Besides bunkhouses and mess halls, the camps should have buildings in which to store forage. In order to avoid damage by hauling forage during the spring when roads were soft, Chittenden felt the feed should be stored during the fall. His idea was for two crews to work from one camp, with each responsible for about five miles of road. The road camps would be situated approximately eight to ten miles apart. Chittenden felt that if this scheme were carried out, the park would have a systematic method for general maintenance, sprinkling and development of the road system.

He also called for Yellowstone National Park to be made a separate district within the Army Corps of Engineers because he felt the amount of work required in Yellowstone was hampered by the additional duties assigned for projects outside the park. He recommended that all work be continued with hired labor. His experience with contractors having been unsuccessful, he suggested teams be hired in the open market on a fixed rate schedule. In 1905, the hiring of teams was the only type of contract labor remaining.¹⁴¹

Chittenden warned the Chief Engineer that proposals by the people of Bozeman and Red Lodge, Montana, for two new roads into the park were objectionable. He believed Yellowstone had enough roads and that the four existing approach roads met the needs of the public. The roads proposed by the citizens of the two communities would be "of local importance mainly, and as such are not justified as public measures." Chittenden estimated that both routes, which would have to cross high country, would only be available for travel for an average of two months a year. He figured the Red Lodge to Cooke City road would cost approximately

YELLOWSTONE ROADS AND BRIDGES

HAER No. WY-24

(page 51)

\$80,000 plus maintenance, and the Bozeman road through the northwest part of the park would cost approximately \$50,000 plus maintenance. Chittenden wrote, "It would be bad policy to increase that burden unless there is positive public necessity for it. It will be a great deal better to develop and perfect the present system of roads than to extend it unduly."¹⁴²

CHAPTER IV

DISSENSION BETWEEN CORPS AND INFANTRY 1906-1911

As a free citizen, I have a right to criticize my government, and I think I can see many ways in which the Park administration might be better; but, in all justice, a great work has been done here. The road system is worthy of unstinted praise. All the roads are good, well graded, well kept, and many of them are macadamized. Throughout the summer the main roads are sprinkled, so that there is no dust--that plague of regular staging.

--F. Dumont Smith

Summit of the World Trip Through Yellowstone

Park

First Lt. Ernest D. Peek, who assumed Major Chittenden's position in spring 1906, faced a shortage of funds due to the late passage of the appropriations bill on 30 June. With a small balance of funds from 1905, he was able to open park roads to the public on 1 June, but he had to dismiss his crews on 23 June because of lack of money. Thus, lack of sprinkling and maintenance left the system in a poor state--excessive dust and deteriorating roads. The Cooke City road suffered many slides during the year and the Tower to Mammoth Hot Springs road, which Chittenden felt needed to be relocated, became dangerous due to numerous landslides. Much of the retaining wall was lost. Peek estimated that at least one mile of road needed to be reconstructed. The transportation companies complained that this section was too dangerous for four-line teams to pass. Examination of the situation revealed that to put the road in a safe condition, it should be widened and in some places, 20' of solid rock would have to be cut through, resulting in a very costly project. Peek concluded that the lower route chosen by Chittenden would be a better alternative. However, lack of funds prevented any action in 1906. Since most of the 1902 plans had been accomplished, smaller appropriations were provided. It had been six years since the park received such a small appropriation: \$55,000.¹⁴³ In March the following year, \$75,000 was appropriated.

Included in the March 1907 appropriation was \$1,000 for a survey of a road to Bozeman through the northwest corner of the park. The proposed route would begin at a point seven miles south of Mammoth Hot Springs on the Norris road and exit the park at a point where the Gallatin River crossed the boundary. Another survey was made for a lower route between Tower Falls and Canyon.

Lieutenant Peek suggested that the visit to the summit of Mount Washburn, which in those days could only begin in July, would be more pleasurable if an observatory could be built. Showing the same sensitivity to the environment as majors Kingman and Chittenden had before him, Peek called for the building to "be built of stone as far as possible in order to harmonize with the surroundings." He estimated that by using the local stone, the structure should cost no more than \$5,000. He thought that the one-story building should have plate glass on all sides and contain a men's and woman's "dressing room". Peek thought that Mount Washburn would receive more visitation if the visitors were shielded from the continual high winds.¹⁴⁴

By the middle of the 1907 season, Peek had supervised the repair of many of the wooden bridges, the replacement of some bridges with culverts, and the construction of one small bridge on the Upper Basin to West Thumb road.¹⁴⁵ Peek continued clearing timber along the roadsides. He tried an experiment of burning the fallen and dead timber in the following areas: on the ground adjacent to the Gardiner-Mammoth Hot Springs road, around the formations and other selected points around the headquarters, on the road from Norris to the Fountain Hotel and 1 1/2 miles beyond, from Riverside Geyser for 1 1/2 miles to the Upper Geyser Basin Hotel, between the road and the lake for 2 1/2 miles from West Thumb toward Lake Hotel and then on both sides of the road for 2 miles beyond the Lake Hotel toward Canyon.

Near Yancey's, crews built a 3/4-mile side road to the Petrified Tree. The hillside around the stump had to be blasted out. Because of the threat of vandalism, an iron picket fence was purchased to protect the tree.

More of Chittenden's suggestions were fulfilled by Peek, including improvement to loading platforms at Apollinaris Spring, Kepler Cascades, Mud Geyser and Upper Falls. He established a number of camps for the road crews, including permanent camps with floored and framed tents near Obsidian Cliff and Canyon Junction. A permanent camp was started on the Lake road, and another was set up at Beryl Springs. Three rough houses were finished on the Continental Divide between West Thumb and the Upper Geyser Basin. Barns were built at two houses and the timber cut for the third.¹⁴⁶

General repairs were completed over much of the road system and the approach roads through the forest reserves. A great deal of work had to be done on the Gardiner to Mammoth Hot Springs road, due to slides and the undermining of the existing dry walls. In autumn 1906, a huge dry slide came down near the first Gardiner bridge. Throughout winter and spring, more sliding occurred,

including a slide 1 1/2 miles down the road from where the first had occurred. In addition to slide problems, the threat of the road washing out caused great concern. Large boulders fell into the Gardiner River and at least twenty breaks in the dry wall occurred about 1 1/2 miles from Gardiner. Peek agreed to Chittenden's suggestion that all dry wall in the park be replaced with walls laid in mortar. He also made repairs to dry wall near Gibbon Falls, Kepler Cascades, and at Upper Falls.¹⁴⁷

In Peek's 1908 request for funding, he pointed out that the amount the park had received for the two previous years had not been sufficient to maintain a safe and good road system. He included in his estimate the funds to purchase three bridges; two for Gibbon River crossings and one for Herron Creek on the West Thumb-Upper Geyser Basin Road.¹⁴⁸

This time the appropriation was \$65,000, and Peek again tried to maintain the existing system by rebuilding bridges and replacing others with culverts. He slowly replaced gravity fill tanks at the sprinkling stations. Peek did not agree with arguments being advanced that the transportation companies should be assessed for the sprinkling of the roads. He was satisfied that the sprinkling served the dual purposes of eliminating dust as a nuisance and preventing the road from being blown away.¹⁴⁹

In 1907, 600 enameled signs were purchased and of the 500 that were set in place that year, all weathered well and seemed indestructible. In addition to the enameled signs, glass-enclosed interpretive signs were set in place at Mammoth Hot Springs for the Soda Springs and at Apollinaris Spring. The signs provided information on the medicinal value and an analysis of the springs.¹⁵⁰

Peek expanded the number of road camps to include ones at Excelsior Geyser, Upper Geyser Basin, West Thumb, Lake and Trout Creek. The third barn, which was started in 1907, was completed at Spring Creek on the Continental Divide road. Peek found that having these accommodations greatly increased productivity, since before the camps were built, crews had to sleep on the ground. Before summer 1908 was over, Peek planned a barn at Beaver Lake and one at Trout Creek. He intended to use locally cut hay at a cost of \$7 and \$8 a ton, as opposed to hauling in hay for \$18 to \$25 a ton. Peek also saved money by having building mangers at Beaver Lake, Beryl Springs, Excelsior Geyser, Upper Basin, West Thumb, Lake, Trout Creek, Canyon, and two other places on the Lake to Canyon road. These mangers prevented the needless waste caused by feeding on the ground.

Excessively heavy rains during the spring of 1908 prompted restrictions on the amount of freight being hauled, and in some cases, on the destinations to which it was being hauled. Unfortunately, damage occurred on some sections before the restrictions were empowered. A 3,500-pound limitation was placed on hauling on the Canyon, Lake, and West Thumb roads. A 5,000-pound limitation was placed on the Mammoth Hot Springs to Norris road and on to the Upper Geyser Basin, and a 5,500-pound limit was placed on hauling on the Gardiner to headquarters road.¹⁵¹

Two surveys were completed for the possible wagon road to Bozeman through the northwest part of the park. Neither of the routes received a recommendation from the superintendent or the Engineering Officer "principally for the reason that the burden of maintaining the necessary existing roads and of properly guarding the park is now very great, and that the proposed new road would add materially to this burden without any corresponding benefit to the general public."¹⁵²

Lieutenant Peek, who left Yellowstone in October 1908, was replaced for a short time by 1st Lt. Arthur Williams. Then in spring 1909, 1st Lt. Wildurr Willing took charge. Willing continued the routine maintenance activities, but the unusually heavy snow during the previous winter and spring again caused sliding on the Gardiner to Mammoth Hot Springs road. The small stream on the hill above seemed to have been the culprit for several years. Sluicing and diversion of the stream came to no avail, and it again caused problems in 1909. Crews had to remove 500 yards of earth which had slid onto the road. In spring 1909, the retaining wall at the bend of the Gardiner River near this point was replaced. However, high water in early June washed out the new section, in addition to a piece of the old wall. One problem was that the water at that point had quite a fall and struck the retaining wall at right angles. In this case, the road was saved by the previous construction of log and sand bag revetments held by iron bars. Willing called for relocation of the road or construction of a massive masonry or concrete wall.¹⁵³

Willing thought Yellowstone should be opened to visitors no sooner than 10 or 15 June. He felt this way not only because of the extra expense required for clearing the snow, but because the snow clearance itself created a natural channel for water, helping destroy the roads. This was compounded by heavy freight wagons having to haul in supplies to the hotels over the wet roads.

By the end of June, the engineers' facilities had been expanded to include a new cottage at Mammoth Hot Springs and a warehouse

and a barn at Beaver Lake. In July, the engineering officer in charge of road improvements and construction was again placed under the direction of the park superintendent.¹⁵⁴ Almost immediately the transportation concessioner, Monida & Yellowstone Stage Company, met with Superintendent H. C. Benson regarding the lack of sprinkling of the roads. Much of the 1909 appropriation of \$65,000 was spent in opening the roads with a large share committed to the south and east approaches. The stage company complained that while the approach roads should receive "some attention," they were not the main tourist roads. In a letter to the general passenger agent of the Union Pacific Railroad, F. J. Haynes reported that since the engineering officers did not initiate their sprinkling until late in the season, visitors experienced considerable dust during June and July. He also told of his wishes for a new cutoff from the Gardiner River to Yellowstone [West Yellowstone], which would shorten the drive from the headquarters to Yellowstone by twelve miles and open up 25 miles of new and interesting scenery along the east side of the Gallatin Range. Since four-fifths of the route was through open country, Haynes estimated that the construction cost would be about \$25,000. He was hoping funds for the cutoff would be in the 1910 appropriation. Haynes, who had already secured the support from H. W. Child of the Yellowstone Park Transportation Company and A. W. Miles of the Wylie Camping Company, requested aid from the Union Pacific, since their business came through the west entrance at Yellowstone.¹⁵⁵

In September 1909, Captain Willing completed an inspection of some of the park bridges and prepared estimates for replacement of those deemed necessary. Many of the existing bridges were constructed of lodgepole pine in the 1890's and were considered unsafe. The life of pine, at that altitude, with its contact with earth and moisture, was thought less than twelve to fifteen years. Willing planned to replace four of the bridges with steel structures in 1910 and others as funds became available. Willing's inspection revealed that the Heron Creek Bridge and the bridge 5 5/8 miles from Norris over the Gibbon River had deteriorated to the point that props under the floor beams would require constant observation until replacements were installed. The deteriorated condition of the Madison River bridge warranted the restriction that teams cross it no faster than at a walk.¹⁵⁶

Plans were drawn for a reinforced concrete bridge to be constructed over the Firehole River near Riverside Geyser. Since this is one of the most visited areas in the park, the superintendent felt that it should necessarily be of an aesthetic design.¹⁵⁷

During the spring of 1910, dissension between Acting

Superintendent Benson and Captain Willing occurred over the sprinkling program. The Congressional Record of 11 March 1910 stated that "a recommendation has been made that none of the appropriation for the roads in the Yellowstone National Park may be applied to sprinkling."¹⁵⁸ Without Benson's knowledge, Willing had inserted a clause in the appropriation bill eliminating the sprinkling. It was exactly the opposite direction from which Major Benson intended to go, as he had instructed Willing to expand the sprinkling program. This transaction prompted Benson to ask the Secretary of the Interior that the authority for distribution of the appropriation be transferred to the Secretary of Interior from the Secretary of War. The Yellowstone Park Transportation Company president, H. W. Child, became very upset, and in a letter to Major Benson, stated that he planned to take the matter up with the Secretary of Interior, the Secretary of War, and Senator Thomas H. Carter. He explained that "The transportation company really represented the Government in handling the tourists in the Park and the dust does not affect the drivers or the owners of the transportation company but it does very materially affect the twenty-five or thirty thousand people who go through the park."¹⁵⁹ Major Benson was concerned for the good reputation that Yellowstone had gained regarding the condition of its road system. In a letter to the Secretary of Interior, he wrote, "Such a suggestion (the elimination of sprinkling) would make travel in the Yellowstone Park--which now is spoken of over the entire world as most pleasant--the worst in the world. He described Captain Willing as "not a practical man and (he) does but little supervising."¹⁶⁰

In summer 1910, the United States Reclamation Service sought permission from the superintendent to travel over a short stretch of the old Falls River trail in the southwestern part of the park. As part of the construction of the Jackson Lake Dam, the Reclamation Service wanted to construct a wagon road from Ashton, Idaho, to Moran, Wyoming. Because of heavy timber, their employees needed to pass over this two-mile stretch until the road was completed. In a return letter enclosing the rules and regulations of the park, Major Benson gave his permission.¹⁶¹

Summer 1911 began with a new officer, Capt. C.H. Knight, replacing Captain Willing and a new Acting Superintendent, Lt. Col. L. M. Brett, replacing Major Benson. Captain Knight carried on with routine work in the park and forest reserves. Because of cost, a steel arch bridge was proposed for the Firehole River near Riverside Geyser, instead of the well-designed concrete bridge that had been planned. A new bridge crossing Pacific Creek was built in summer 1910. In late fall 1910 and in May 1911, a concrete retaining wall 487' long was started and

completed at the bad point on the Gardiner to Mammoth Hot Springs road. This was the first concrete retaining wall revetment built in the park. The engineers felt that the next major replacement of retaining wall should be the 1,000' dry rubble walls along other sections of the Gardiner road and also along the Gibbon River.¹⁶²

In the summers of 1910 and 1911, a road was constructed along the Gallatin River from Taylors Fork to Yellowstone [West Yellowstone] by Gallatin County. The road passed into Yellowstone for about fourteen miles near the park's western border. Permission was granted to the road contractors, Moore and Moore of Eldridge, Montana, to build a small log cabin within the park. The site, which was to be out of view from the road, would be selected by the non-commissioned officer stationed at the Gallatin Station. Under certain restrictions the contractor was allowed to cut logs for the cabin's construction and for bridges on the park section of the road. As part of the agreement, upon completion of the road, the cabin, which was used for storage of tools and equipment, would be turned over to the Army. After completion of the road in October, the county commissioners appealed to Colonel Brett for permission to allow automobiles to travel over the new road.¹⁶³ The commissioners stated "We cannot see where there would be any objection for the reason that our road does not connect with any road entering the park until the town of Yellowstone is reached." Brett replied that no permits for passage of automobiles had yet been granted, but he would forward the appeal to the Secretary of Interior.¹⁶⁴

CHAPTER V

FROM WAGONS TO AUTOS 1912-1918

The 150 miles of road which the average park motor tour embraces are far superior to the dirt and macadam highways found generally in the West.

--Chester Davis, "Motoring Through Wonderland",
1915

The question of the entrance of the automobile on the park roads took on serious debate and examination by the Army, the Department of Interior, the transportation concessionaires, and the public in general. At the 1911 National Parks Conference held at the Canyon Hotel in Yellowstone National Park, the issue of automobiles in parks was discussed in a session called "Transportation in the Yellowstone National Park," facilitated by F. J. Haynes, president of the Monida & Yellowstone Stage Co. All three major transportation concessionaires in Yellowstone opposed the entrance of automobiles, but did support the idea of constructing a parallel road for automobiles. Haynes suggested the alternative of a self-propelled gasoline passenger rail car line which would provide access to all of the points of interest, connecting with the existing northern and western rail terminals. The cars, which would be equipped to handle all the freight for Government and hotel needs, would eliminate the need for freight hauling over the existing road system. Haynes further stated that the Yellowstone Transportation Company and the Wylie Permanent Camping Company would be willing to "finance, construct, equip, and operate this proposed means of transportation" if they received approval from the Department of Interior.¹⁶⁵

A lively discussion followed the talk in which the general feeling was not all-out opposition to the entry of automobiles on park roads, but that specific parks may not be as conducive to automobile use as others. In fact, automobile roads were encouraged in some parks such as Mount Rainier, Glacier and Crater Lake. The following spring, the United States Senate called for an estimate of the cost of constructing new roads, or reconstructing the present system, to accommodate the entry of automobiles and motorcycles without interfering with conveyances drawn by horses or other animals.

Capt. C. H. Knight responded in May 1912 with a lengthy document outlining the historical development and existing condition of the road system, the improvements required to bring the road to a

standard that would allow automobile traffic alongside the animal-drawn vehicles, and a plan for a new system that would only accommodate automobiles. The document covered in great detail the advantages and disadvantages of automobile traffic. The question was not whether or not to permit automobiles in Yellowstone National Park, but how they would be accommodated. The final conclusion by the Army engineers was that the existing road system should be reconstructed to meet the needs of automobile traffic.

The three major transportation concessionaires, however, pushed for a separate road system for automobiles. They felt that the 2,000 horses used in the park would never adjust to the automobiles, as they were on the open range for almost eight months out of a year. Introduction of automobiles would cause runaways and accidents. The concessionaires also worried about the investment they had in horses and equipment, and they were concerned about hazards and delays that the two different forms of transportation would cause.

The Army included the solicited views of the transportation concessionaires in the report to the Senate. The Army's recommendation, however, called for the reconstruction of the existing road system at an approximate cost of \$2,265,000. This single road system would accommodate automobiles, motorcycles, and animal-drawn vehicles.¹⁶⁶

At the same time Captain Knight was sending his report to Washington, road crews were fighting the almost annual Gardiner to Mammoth Hot Springs road landslides. During the middle of May, the soldiers kept the road open, but warm days and spring rains caused the Gardiner River to rise. Fearing rising water would wash away the retaining walls and portions of the road, Col. Brett requested approval to spend \$500 on the repair of the old wagon road from the headquarters to Gardiner. The engineers felt visitors would have no trouble reaching Mammoth Hot Springs if they used light vehicles. This wagon road was not one of the roads on which appropriated money was to be spent.¹⁶⁷

This 4 1/2-mile wagon road had been impassable for vehicles and was considered unsafe for pack and saddle horses. A new 25' timber span bridge with a 12' approach on each end replaced an old wooden bridge on the route. Several other smaller bridges and eleven culverts were constructed of wood. Some sections were recorduroyed and boulders were removed by either blasting or excavation. The roadway was widened and graded.¹⁶⁸

Appropriations for 1912 and 1913 increased appreciably over those of the previous six years, with the park receiving \$177,33.34 and

\$200,000 respectively. The number of miles of sprinkling had increased to 100 with plans for experimenting with road oiling during the 1914 fiscal year. Oil and water tanks were built at Mammoth Hot Springs for later use throughout the park. A 30' timber truss bridge was built over Alum Creek and a number of other bridges were redecked and painted. Numerous bridges were replaced by culverts and many wooden culverts were replaced with metal ones. A new 650' retaining wall made of stone set in mortar was constructed on the Gardiner to Mammoth Hot Springs road. Additional stone replacement work was done through the Gibbon Canyon area and near the Virginia Cascades, on the Norris to Canyon road. A new barn was completed at the Trout Creek road camp, a log storehouse was built at the east entrance, a log cabin/storehouse was built at the Lake sprinkler camp, and a wagon shed with storage loft was finished at Mammoth Hot Springs. The location of the house at Mammoth Hot Springs was changed, plumbing fixtures were added to the outhouse there, and the bunk house at headquarters got running water and washing fixtures. The Mud Geyser platform was rebuilt.¹⁶⁹

Secretary of Interior Franklin K. Lane permitted automobiles to travel on the newly built road between Bozeman and Yellowstone [West Yellowstone] in 1913. However, the road was not in condition for automobile travel until 1914. The 17.86 miles of road that lay within the park had forty-seven bridges on it.¹⁷⁰ In January 1914, the Gallatin County commissioners appealed to Congressman John K. Evans for government funds for the improvement of the seventeen miles of the West Gallatin road. As justification for the request, they claimed the park used the road for transporting supplies from the rail station at Yellowstone [West Yellowstone] to the Gallatin Soldier Station, that Yellowstone authorities used the road for other purposes in line with routine park business, and that tourists used the road on their way to the West Entrance of the park. The Gallatin County officials stated they had already spent a total of \$47,500 on the road, including \$10,000 on the park section. They now estimated that they needed an additional \$45,000 for improvements to the 17.8 miles of road, or about \$2,500 per mile.¹⁷¹

The Army's response to Gallatin County's appeal was to not recommend funding for either improvements or maintenance. The Army said that the soldiers used the road "to some extent by park patrols, but it is not an absolute necessity." Most supply trains used the trails from Fort Yellowstone since the trail route was approximately forty-five miles shorter than the road via the West Entrance. The Gallatin Soldier Station reported that only twenty-four parties (113 people) had used the road during the summer season of 1913. The Army felt that the cost of maintenance and improvements to the road could not be justified

by the benefits gained. The Army's estimate for the annual maintenance requirements was approximately \$3,000; they would not speculate on the cost of improvements, as the engineers had not inspected the road, but from their experience with similar roads, they felt it should have cost no more than \$1,000 per mile.¹⁷²

In June 1914, Captain Knight was transferred to the Second Battalion of Engineers in Texas, and was replaced by Maj. Amos Fries.¹⁷³ Until the end of June, mostly routine maintenance was performed, with an emphasis on upgrading roads to make them safe for the passage of both animal-drawn and motorized vehicles. The road sprinkling covered 100 miles and some oiling was being tried. Three reinforced concrete bridges were built. One 40' reinforced-concrete arch bridge was built over the Firehole River near the Lone Star junction; a 40' span reinforced concrete bridge was constructed over the Gibbon River, seven miles from Norris, and a 65' single span girder and slab bridge was built over the Gibbon near its confluence with the Firehole River. A 40' steel arch bridge was built over the Gibbon near the Wylie Camp, seventeen miles from the West Entrance; two 40' span wooden bridges were built over Pacific Creek, south of the park in the forest reserve and a 10' reinforced concrete arch culvert was installed at Spring Creek.

Between the second and third mileposts on the Gardiner to Mammoth Hot Springs road, 120' of cement rubble masonry retaining walls were constructed. Crews rebuilt retaining walls on the Mount Washburn road, the Virginia Cascades section of the Canyon to Norris road, and in Gibbon Canyon. They also built barns at the Gibbon Meadows and Grand Canyon camps, cabins at the Beaver Lake and Grand Canyon camps, and two "public-comfort houses" in the Norris Geyser Basin.¹⁷⁴

In addition to the admittance of automobiles, in August of 1914, the Acting Superintendent unsuccessfully sought permission to extend a spur of the Oregon Short Line Railroad into the park for 100' in order to facilitate filling oil tanks that they wanted placed inside the park.¹⁷⁵

Major Fries instituted a new organizational plan for the road construction program by separating the park into three divisions. The Western Division, under the supervision of William O. Fraesdorf, would cover the Gardiner to Yellowstone and the West Gallatin roads, and from the junction of the Firehole and Madison River along the Firehole to the Upper Geyser Basin. The Central Division, under O. R. Kroell, would cover from Tower Falls to the Snake River, from Canyon to Norris, and from West Thumb to the Upper Geyser Basin. The Eastern Division, under R. D. Rader, would cover the road through the forest reserve to the road

junction at Lake. In August 1915, a new Northern Division was created under the supervision of Capt. John W. N. Schultz.

Another change Major Fries instituted was in earth loosening and hauling procedures. He found the most economical way to loosen the earth and gravel was by plow, employing scrapers to haul it; he found that the most desirable mixture for the road surface was a mixture of one third clay and two thirds sand. Fries instructed the crews to use material from the side of the roads for temporary repairs unless they were finished roads that were completely macadamized, in which case gravel or broken stone was to be used. He felt that the hauling of gravel or sand for long distances was about as "nonsensical as patching cotton clothes with fine silk."¹⁷⁶ His approach to filling ruts or chuck holes on macadamized roads was to first clean out the hole and scratch the surface to facilitate a bond with the new material. The fill material had to be screened gravel or rock bound with clay or stone dust so that after watering, the repair would wear as well as the macadamized road. Fries ordered the construction of 3 1/2' ditches on either side of the 18' standardized road. Hillside ditches were to have drains not more than 100' apart and they were to be as wide and deep as possible. Fries said that to a good road man, "A road without ditches looks as natural as a man's face without a nose." Fries called for the templates to be tried at certain sections of the road and for the road to be "brought to proper crown." Fries, who ran a "tight ship," felt "the best workman is the one that can do first class work at the lowest cost." He was strict on workmen's output, insisting that a day's work was eight hours, with no exceptions for going to or from work or for lunch.¹⁷⁷

By spring 1915, other improvements had been finished. Telephones were installed at the engineers' camps and most of the other road camps scattered throughout the park. A covered rack for the storage of reinforcement steel used in the concrete bridges and culverts was built at Mammoth Hot Springs, along with a steel and concrete gasoline storage tank, capacity one carload. Concrete tanks, each capable of holding two carloads of oil, were built at Gardiner and Yellowstone, Montana.

Sprinkling continued on 112 miles of roads and oiling was tried on two sections. In 1915, the engineers planned to use a finish of 90 percent asphalt oil and broken stone. The least expensive of the two brands scheduled for use cost 2.1 cents per gallon at San Francisco, with a freight cost of 4.5 cents to Yellowstone, Montana, plus an additional 6 cents per gallon freight cost for fifty miles inside the park. In order to save some cost per mile, the Army continued to push for the construction of two lengths (66') of rails to be built adjacent to the rail station

in Yellowstone, Montana, to just inside the park boundary. Prior to receiving permission, the Army planned to build a pit just inside of the Yellowstone boundary. With certain limits, such as the restriction of the engine to come into the park, the construction of an obstruction which would prevent cars from coming into the park without Army supervision, and the understanding that the track could be removed at the Department of Interior's request, permission was granted in May 1915.¹⁷⁸

Following earlier decisions, only concrete bridges were built on the Belt Line and steel bridges with concrete floors in the forest reserves. Red spruce was the preferred material for abutment sills on the wooden bridges. For economic reasons, all the concrete bridges were built by day labor. If a span of 10' or less needed to be bridged, a culvert was installed; more than 10' was to be spanned by a bridge.

Major Fries believed the practice of building bunk houses and barns was impractical. He felt that for them to be effective required placing them in locations that would offset the long and too-costly commutes the crews had to make. He preferred the use of 16' x 24' tents.¹⁷⁹

On 1 August 1915, the first automobiles were allowed into Yellowstone, with both positive and negative effects. During the dry and dusty season, the heavy touring cars and light, high-speed trucks were harmful to the road surface. However, during the wet season, vehicles had the opposite effect. Besides the cars being easier on the roads, their pneumatic tires had a decided ironing effect. The slower speed, heavier trucks with solid tires had a detrimental effect on the road, especially during wet weather when their chained tires cut deep ruts into the surface. Thirteen trucks replaced most of the six and eight-horse teams, which were also detrimental to the park roads because of their practice of following the same ruts.

A five-ton White truck, purchased in 1915, greatly reduced the cost of hauling in the park. It immediately became the "workhorse of the park" by operating sixteen hours a day in plowing, grading, dragging, and hauling.¹⁸⁰ The Army engineers felt that in order to achieve a reasonable per-mile cost for construction and improvements, sufficient money should be spent on necessary equipment.¹⁸¹

With 3,445 automobiles entering the park between 15 June and 30 September 1916, Yellowstone advanced into a new era of tourism. A couple of years earlier, the park began planning for increased visitation due to World War I (which prevented many Americans from venturing abroad) and expositions in San Francisco and San

Diego. The newly formed Park-to-Park Highway Association, which met at the Canyon Hotel in Yellowstone, focused the attention of other clubs and government officials on the opportunities of traveling to the national parks on a connecting system.

Regular routine maintenance and improvements were carried on during 1916. The major road problem was correcting the continual slide problem on the Gardiner-Mammoth Hot Springs road. Slides had occurred over a number of years, and in 1915 much work was done, placing the in what was considered to be good shape. However, during that summer and winter, slides reduced the road width to 10' and new slides developed several hundred yards closer to Gardiner. Slumping at the new slides caused the road to be closed several times in fall 1915 and four times in spring 1916. Blasting and grading prepared the road for tourists in 1916, but the work and high water in spring caused sections of retaining wall to give way and/or weaken.¹⁸²

As a result of increased automobile travel to the park via the West Entrance, the Army engineers reversed their opinion regarding government funding for improvements to the 17.8 miles of the West Gallatin Road. In his 1916 annual report, Major Fries requested the government assume responsibility for the maintenance and repair of the this section.¹⁸³

On 25 August 1916, the National Park Service was created, but the military continued to have a presence in the park until 1918. A civilian, Chester A. Lindsley, was appointed park "supervisor" and remained the administrator until Horace M. Albright was appointed superintendent on 28 June 1919. Many of the discharged cavalry soldiers remained in the park either as rangers or in the maintenance department.

In the following year, improvements to approach roads and important realignments to the Belt Line were made. Robert McKay of the Buffalo Mining Company, which had mining interests in the Cooke City area, continued with improvements and repairs to the Cooke City road. During the previous year, McKay had made great improvements to the road by cutting out four hills with dangerous curves, accomplishing some realignment, providing light graveling on some sections, and building a 30' span bridge with gravel-filled log cribbing approaches extending 100' across Pebble Creek.¹⁸⁴

After more trouble with the slide area on the Gardiner and Mammoth Hot Springs road, the engineers finally decided that perhaps a relocation of the road across the river, which would be very expensive, or rebuilding the old freight road, might be desirable.

The United States' entry into World War I in April 1917 hastened transfer of road responsibility to the newly created National Park Service. In July, when Lt. Colonel Fries was transferred to France and Capt. John Schultz assumed the responsibility over the road work. Over the previous few years, there had been tensions between the concessionaires and the military engineers over road damage and maintenance responsibilities. The concessionaires were operating under new contracts, which compelled them to pay, "as for consideration for their privileges, on a schedule of charges that will bring in, at the close of the season, a very large sum of money which will be used in administrating the park."¹⁸⁵ Prior to leaving Yellowstone, Fries wrote Albright advising him of the problems, stating

The Transportation Company doesn't seem to appreciate that everything they have in the world came from the roads and that all the fortunes they expect to make in the future will come from the same place so that instead of cooperating and letting us have transportation at reasonable rates when we want to rush men to fix bad places often caused by their shoveling out the snow and then driving heavy cars continually in one track, they sting us the limit for every man and piece of material hauled for us.¹⁸⁶

In October 1917, Secretary of the Interior Lane inspected the road system in Yellowstone National Park. While on his visit, Lane made a number of suggestions for improvement, including a request for a painted white or whitewashed railing at a point 7.1 miles from West Thumb, construction of preferably stone guard rails at dangerous points between Chittenden Bridge on Upper Falls (heavy pole rails painted white would be an alternative), and grading the slopes to the inside bank at a point where the road approached Dunraven Pass from Canyon. At Gibbon Canyon, he recognized a safety and visual problem in the growth of small trees since the road was built. He found the trees obstructed the view of the river and in turn made for dangerous driving. He also felt that the removal of a few trees at Gibbon Falls would "afford a better view."¹⁸⁷

A few months earlier, an assessment of the road conditions was compiled. However funds were running out, so Captain Schulz advised Lindsley that some of the work would have to be completed the next season.

As a result of the creation of an agency to administer all the national parks and national monuments, many organizational changes would be made in Yellowstone. During 1917, more attention was given to road work by the newly created National Park Service. In fact, prior to Secretary Lane's visit to Yellowstone, he had written a letter to the Secretary of War proposing that the Interior Department take over the road work in both Yellowstone and Crater Lake national parks. Horace Albright, assistant to Park Service Director Mather, shared similar feelings and in a letter to Secretary Lane wrote:

I do not know what can be done about it now, but one thing is certain, we can not make the national parks the place for the engineers to get their road building education. We need trained road builders in the parks, not inexperienced West Point graduates who go there to learn this branch of engineering and control the thing at the same time. The Yellowstone now has the worst roads of any national park, except Rocky Mountain where we have nothing to do with the improvement work, and now is the time that we must do something.¹⁸⁸

The last Army Corps of Engineers officer at Yellowstone, Maj. G. E. Verrill, supervised the road work until 30 June 1918. Prior to his departure, more routine maintenance and improvements were carried out. Crews worked continually trying to keep the Gardiner-Mammoth Hot Springs road open throughout summer 1917, but the 1918 spring thaw caused extensive movement in the slide area and high water in June resulted in the complete destruction of a one-mile section of the road. The engineers were forced to abandon the road and make improvements on the old freight road until the main route could be reconstructed.

The June flooding wreaked havoc in a number of other locations in the park. Road sections at the Snake River and Pilgrim Creek bridges in the southern part of the park and in the adjoining national forest were damaged. Road segments and bridge approaches were damaged on the Cody road. On the Cooke City road, the Lamar River, Pelican Creek and Soda Butte Creek bridges were washed away. Because this road was not heavily traveled by tourists, the park did not initiate immediate repairs. Using some materials supplied by the engineers, private citizens from Cooke City built a cableway over the Lamar River to convey supplies and people.

By the time the Army left the park, all the significant wonders or scenic areas were accessible by motor-drawn vehicles and all entrances were open to travel. There were no serious problems on

the 137-mile Belt Line, other than a worn foundation and lack of original surfacing material. The entire system needed to be macadamized or graveled. As stated, the north approach road had been washed out and the only entrance was via the old freight road which was muddy and slippery during wet weather. Of the 13 1/2 miles on the west approach road, 9 1/2 had been macadamized. Five of the 9 1/2 miles were considered in excellent condition, with a macadam surface covering an 18' width; the remainder had a macadamized width of 10'. All but two miles of the 23-mile south approach road had been widened and graded, and with the exception of the June high water damage, it was considered to be in good condition. For the past few years, the only work done on the forest service road was the thirty-mile section just south of Yellowstone. Little had been done on the section south of the Moran Post Office. The 26-mile East approach road was considered to be in fair to good condition, but the 28 miles through the national forest was heavily damaged by the June flooding. Prior to that time, the road was considered to be in good condition. Other than the June damage, the Cooke City road was also considered in good condition, as were the Bunsen Peak, Artist Point and Inspiration Point roads. The road through the Mammoth Hot Springs terraces was rated as poorly suited for motor-drawn vehicles and in fair condition for horse-drawn or foot traffic. Bridges were all adequate, with the exception of a wooden span over the Firehole, .6-mile southeast of Old Faithful Inn; a wooden bridge across the Gibbon at Norris; two wooden bridges near Canyon Hotel and a wooden bridge across Blacktail Creek; plus a number of bridges in the national forest.¹⁸⁹ Stephen Mather viewed the later years of the Corps' road work as years with an

entire lack of a comprehensive policy which considered the popular uses of the Park, and in later years, the failure to give any degree of permanency to the organization of the engineering force. Engineer officers were detailed to the park for short periods of time, then replaced by others, who often came with different ideas from their predecessors; there was constant altering, modifying, and changing of plans for improvement work and of methods of performing this work.¹⁹⁰

Mather thought the new combined management of Yellowstone under one department and one park supervisor or superintendent would eliminate the double, and in some cases, triplicate effort. For the past two years, Yellowstone had a superintendent who reported to the Secretary of Interior, a District Engineer who reported to the Chief of Engineers of the Army, and a commanding officer of the troops, in charge of protection of the park, who reported to

the Western Military Department in San Francisco. In 1918, the assorted offices were combined and the former Engineers' Building became park headquarters.¹⁹¹

In May 1918, Interior Secretary Lane issued a "Statement of Policy" in which road construction and improvements were specifically addressed.

In the construction of roads, trails, buildings, and other improvements, particular attention must be devoted always to the harmonizing of these improvements with the landscape. This is a most important item in our program of development and requires the employment of trained engineers who either possess a knowledge of landscape architecture or have a proper appreciation of the aesthetic value of park lands. All improvements will be carried out in accordance with a preconceived plan developed with special reference to the preservation of the landscape, and comprehensive plans for future development of the national parks on an adequate scale will be prepared as funds are available for this purpose.¹⁹²

This philosophy expressed by Secretary Lane is reminiscent of those expressed by captains Kingman and Chittenden of the Army Corps of Engineers.

CHAPTER VI

To one visiting our national parks and monuments, there are two features which stand out prominently--scenery and highways, or it would be better expressed to say that the one stands out prominently by its abundance and magnificence and that the other is called to the attention by its lack of everything that it should be, even to its very existence.

--"National Park Roads Vitally Needed,"
in *Western Highway Builder*, 1922

The transfer of responsibility for the road engineering work in Yellowstone coincided with the early development of national programs directed by the two-year-old National Park Service, under the leadership of its director, Stephen Mather. Mather created a landscape engineering division under the supervision of Charles P. Punchard, Jr., and a civil engineering division under George E. Goodwin. The responsibilities of the engineering division were developing plans for new roads and trails, gathering information relating to road and trail projects, presenting the information to the director and the Secretary of the Interior, and finally, to Congress.

In Punchard's first year, he visited thirteen national parks and national monuments, including Yellowstone. Mather praised Punchard, saying he had the "ability and willingness to take a very practical view of the problems to be solved, and to attack them always with full appreciation of the limitations of the park appropriations and the relation of these problems to other features of improvement of the park system."¹⁹³ Punchard's national overview of needs and requests was very important at the time appropriations were distributed. Prior to the creation of the National Park Service, each park area operated independently under the overall guidance of the Department of the Interior.

In June of 1919, Mather appointed his assistant, Horace M. Albright, Superintendent of Yellowstone. Chester Lindsley, who had directed park administrative functions during the transition, stayed on as Assistant Superintendent. On Major Verrill's

departure in 1918, Goodwin took charge of the road projects. Albright reported for duty on 10 July 1919, and for the next ten years would have a major influence on the development of the park.

According to Mather, the first important engineering project undertaken by the newly formed engineering division was construction of a new road through the Gardiner River Canyon. He felt that several bridges designed by the new division for the park system were very important, including the underpass bridge for Sylvan Pass, which replaced the notorious "corkscrew" bridge, and the Marble Fork Bridge in Sequoia National Park.

Mather expected great advancements for Yellowstone in several areas. He foresaw unlimited opportunities for the park that had experienced the highest number of visitors to date, 62,261. Combined with the "See America First" campaign, the Park-to-Park Highway movement, and the end of the war, Yellowstone expected a continuing rise in visitation, especially from motoring tourists. Mather worried about the public's opinion that "it (the park) has lost much charm, that it seems less wild. . . . they experience a longing for the stillness of the forests and peculiar fascination of the park in the stagecoach days."¹⁹⁴ He believed:

the automobile should revolutionize the park tour, just as it changed travel conditions everywhere and turned into memories cherished methods of seeing and doing things. However, the old atmosphere of the Yellowstone is still to be enjoyed, not perhaps on the roads, certainly only a few hundred yards distant, where the trails take their winding course through the forests."¹⁹⁵

During Mather's September 1919 tour of Yellowstone, he found the road system in an "excellent state of repair," but with the predicted tremendous increase in motoring tourists, he recommended the widening of many sections, reconstruction of bridges and culverts and the construction of stone guard walls. He also recommended completion of the Firehole cutoff and restoration of the old road along Lake Yellowstone from West Thumb to near the Lake Hotel. He suggested the Gallatin road be widened and that section south of the park boundary from Grayling Creek to Yellowstone, Montana, be rerouted within the park boundaries. Mather felt the approach roads to the park, including a portion from Livingston, Montana, should either be taken over by the federal Government or at least the state should be given funding assistance.¹⁹⁶

When Albright took over at Yellowstone, there were 278.8 miles of

primary roads and 24.75 miles of secondary roads. The park maintained 28 miles of the Shoshone National Forest road and 30 miles of the Teton National Forest road. Most of the 1919 road work consisted of routine maintenance and improvements; however, much time was lost during August when the road crews were pulled off to perform fire fighting activities. Additional time was spent moving around camps, corrals, and equipment.¹⁹⁷

Consideration of landscape architecture was having a more pronounced effect in the park after the National Park Service assumed responsibility for road improvements and construction. In 1919, Charles Punchard ordered vista cuts on the Upper Geyser Basin to West Thumb road in order for Duck Lake to become visible to passing tourists, and on the Mammoth Hot Springs to Tower Falls road so that Wraith Falls might be seen by visitors.¹⁹⁸

In Albright's first annual report to Director Mather, he made eighteen recommendations for improvements, or as he called them, the "urgent needs" of the park. Over half of the "urgent needs" were road related.

Congress failed to appropriate any funds for road construction for 1920 in any of the national parks, and the engineering division used the year to prepare plans and specifications for numerous projects. In Yellowstone, estimates and specifications for paving the roads were prepared. The civil engineering office drew standard designs for rustic log bridges of 12' to 90' span lengths, for timber and corrugated metal culverts (both with and without headwalls) and for concrete arch culverts. The office also prepared standard specifications for the purchase of construction equipment and machinery.¹⁹⁹

Between the autumns of 1919 and 1920, some 80,000 people visited Yellowstone. With 50,000 visitors arriving in 13,502 automobiles, it was not surprising that by season's end, roads were worn out in many sections. In Mather's annual report to the Secretary of Interior, he stated that the 1919 projects should be completed at an early date. He suggested additional guard walls or stone parapets be constructed for visitor safety.²⁰⁰

With the discussion of a possible extension of the boundaries of Yellowstone National Park, Mather wanted to make it known to the Secretary of the Interior that even if additional lands were added, he would not recommend construction of any more roads. He felt that the Yellowstone was adequately serviced by the present 400-mile road system, and feared the extension of roads would ruin the wilderness qualities and harm the wildlife habitat. He wrote:

it is my firm conviction that a part of the Yellowstone country should be maintained as a wilderness for the ever-increasing numbers of people who prefer to walk and ride over trails in a region abounding in wild life[sic]; also, I think a road around Lake Yellowstone or in the Upper Yellowstone and Thorofare country would mean the extinction of the moose. I am so sure that this view is correct that I would be glad to see an actual inhibition on new road building placed in the proposed extension bill, this pro-viso to declare that without the prior authority of Congress no new road project in this region should be undertaken.²⁰¹

Albright revived Hiram Chittenden's successful method of using road section crews stationed every few miles on the main routes. These crews were responsible for keeping a section in first class order. The lack of funding, which prevented the hiring of men to clear away snow, prompted the master mechanic in the park to devise a snowplow fashioned from 1/4" boiler steel sheets used in front of a 75hp Holt caterpillar. With this new piece of equipment, the park was able to clear an 11' wide path from headquarters via Grand Canyon to Lake Yellowstone before 1 June.²⁰²

Most of Albright's recommendations for 1920 were the same as those for 1919, with the addition of a request that any park revenues be used for maintenance and improvements in Yellowstone.²⁰³

All the national parks in the system needed expert advice on landscape architecture questions. Since the Landscape Engineering Division covered road and trail locations, vista cutting, placement of developed areas, suggested design of important structures or buildings, and general cleanup, Charles Punchard's needs were eased by the hiring of Daniel R. Hull as assistant landscape engineer in August 1920. That year, an effort was initiated to harmonize and standardize all the park signs. Yellowstone's master painter painted all of the metallic signs green and white, using red for warnings. All the signs were affixed to posts instead of trees, conforming to the new landscape policy on signs.²⁰⁴

During 1921, many of the requests for road improvements were fulfilled and both Mather and Albright received high marks for the condition of the roads from the visiting public. One man who had visited Yellowstone for the past 38 years said that he had never seen the roads in such good order. Both Mather and Albright laid the credit to Chittenden's section crew approach.²⁰⁵

Major construction projects in 1921 were widening projects over Dunraven Pass and at the Grand Canyon, and construction of stone parapets between the Upper Falls and the Canyon Bridge. A new steel and concrete bridge was placed over the Gibbon River near Norris. The Lamar River Bridge was reconstructed and a new foot bridge over the Firehole near Castle Geyser was built.

The sprinkling program now covered 107 miles of the road system. A series of 144 supply tanks ranging from 600 to 3,000 gallons capacity supplied two motor-driven sprinklers, two two-horse sprinklers, and fifteen four-horse sprinklers. Fourteen of the tanks were replaced with 1,600-gallon nonshrinkable redwood tanks and one 3,000-gallon capacity nonshrinkable tank. Many of the worn-out pipes were replaced, new flumes and ditches were built; and a number of the supply tanks were relocated to improve the landscape.²⁰⁶

In 1921, wooden mess halls were built for road camps at Tower Junction, Madison Junction, Excelsior Geyser and Gibbon Meadows. Most of the building material came from the razed Yellowstone Western Stage Company buildings at West Yellowstone. Each of the 16' x 22' buildings contained a kitchen, dining room, and cook's bedroom. The roof extended 6' beyond the front wall to form a porch, which was enclosed by screening. Doors and windows were also screened.²⁰⁷

The master painter stayed busy throughout 1921 building 600 signs (mostly small types for comfort stations, camping areas etc). In addition to the National Park Service signs, some came from a Michigan firm, Hardesty Manufacturing, which had been awarded a contract for supplying all national parks with signs.²⁰⁸

Increased attention was now devoted to the improvement of park roads and the connecting state and federal highways. With the 1920 designation of the Park-to-Park Highway, Mather hoped that pertinent states would seek federal aid for improvements. He pushed for legislation that would recognize the position the park roads and feeder roads had in the overall national road development policy. He asked for \$500,000 a year for five years to enable the parks to meet standards expected by the motoring public. He advised Secretary of the Interior John Barton Payne that there was "not a single paved road in the national park system at this time." Another movement toward enhancement of the highways in the western states was the effort by Governor Olcott of Oregon to preserve strips of timber along the roads leading to parks or along major tourist routes.²⁰⁹

The National Park Service landscape engineering and civil engineering divisions worked closely on the designs for buildings, bridges, roads, and all physical improvements. Mather felt that the cooperation between the two offices offered "the greatest possible good from a scenic and economic standpoint in the expenditure of public moneys for our projects." During the summer of 1921, Maj. W. A. Welch, general manager of the Palisades Interstate Park along the Hudson River in New Jersey and New York, visited several western parks, including Yellowstone. This would not be the last time that a parkway builder from the East would give suggestions for improvements to Yellowstone.

In November 1920, Charles Punchard died and his assistant, Daniel Hull, assumed his position as head of the Landscape Engineering Division. This change would have positive effects on Yellowstone's appearance. Hull suggested to the superintendents that new borrow pits, sprinkling stations, and telephone and electric service lines be placed in the least noticeable positions. In the past, most of these services had been placed in the "easiest" location, without regard to the effect on their landscape.²¹⁰

Secretary of the Interior Albert B. Fall and Director Mather inspected a major portion of Yellowstone during the autumn of 1921. After this visit, Mather was more convinced and finally concurred with Superintendent Albright's view that, with the exception of a new road from the Upper Geyser Basin to the southwest corner of the park, no more roads should be built.

After his visit, Mather once again expressed hope that the federal government would aid the states with sufficient funds through new road bills to enable them to improve the approach roads. The State of Montana felt that the National Park Service should at least be responsible for the first twenty miles leading out of the park on the north and west sides, as they were responsible, under congressional obligation, to maintain the south and east roads into Wyoming. Also during 1921, the Yellowstone Park Transportation Company suffered its first automobile related fatality. Considering the numbers of people the company had moved by motor vehicle over the past six years, it was an exceptional record.²¹¹

In 1922, Yellowstone celebrated its 50th anniversary and 100,000 people visited the park. More than half of these were motorists rather than rail passengers. Less than twenty accidents, with one fatality, occurred on the park roads for the season. Improvements during the year included graveling many parts of the loop system and the construction of more guard rails on sections

that skirted precipices and on dangerous curves. After three years of construction, the Dunraven Pass Road was completed and the Bunsen Peak Road was improved to a standard that enabled automobiles to travel over it. Several new bridges, both inside the park and on the approach roads, were constructed including a 32' span steel I-beam bridge with reinforced concrete walls and railings over Mormon Creek, a 20' span concrete I-beam bridge over Goff Creek, and 12' reinforced concrete slab bridges over Newton and Pagoda creeks.²¹²

The condition of roads across the national park system began to receive more attention nationwide as state and federal roads programs outside the parks surpassed road conditions within. This situation caused park visitors to comment on the noticeable difference. The federal government had appropriated several million dollars for road work in the national forests, but none of the Federal Aid Road Acts included money for the national parks. Each park received only a small appropriation. By 1922, only two national parks, Yellowstone and Crater Lake, had complete road systems, and these still needed improvements to bring them up to first-class standards.

Secretary of the Interior Fall wrote to the director of the budget:

It is my judgment that only by the adoption of an authorized road program can the anomalous situation of having well built convenient roads leading to the national park boundaries, and then having inadequate or insufficient roads through the parks themselves, be cured, and just criticism of the national administration of the parks be avoided.²¹³

Fall proposed a \$7,296,000 three-year road budget for all the parks and monuments in the system. Unfortunately, the budget was rejected and Fall only received money for ongoing projects authorized by Congress. He feared that the popularity of the parks, as evidenced by the increase in visitation from 488,268 in 1917 to 1,217,490 in 1922, would suffer if the roads were not constructed or put in better condition.²¹⁴

The manager of the Good Roads Board of the California State Automobile Association wrote in an article "National Park Roads Vitally Needed" that:

To one visiting our national parks and monuments, there are two features which stand out prominently--scenery and highways, or it would be better expressed to say that the one stands out prominently by its abundance and magnificence and that the other is called to the attention by its lack of everything that it should be, even to its very existence.²¹⁵

In early 1923, a speech about national parks roads was delivered before the United States Congress by Colorado Senator Lawrence Phipps, in which he recognized that World War I had changed the face of travel in the United States. Prior to the war, a large percentage of the American travel dollar was spent in viewing European wonders and sites, but as a result of effective boosterism, such as the "See American First" campaign and efforts of organized motor clubs, combined with the tragic situation in many parts of war-torn Europe, more Americans began to travel within the country. He stated that nearly two-thirds of the visitors who came to the parks in motor vehicles brought their own camping equipment. He called upon his colleagues to question, "Then what about the roads--that prime necessity of motorists?" He explained that as of the beginning of 1923, only about five miles of oiled macadam roads existed in Yellowstone and a short section of paved road in the Grand Canyon, the latter financed by the railway! Senator Phipps elaborated further on the road situation across the national park system. Only Yellowstone and Crater Lake had complete road systems. No government money had been spent on the roads in Hawaii, Wind Cave, General Grant, Lafayette, Mount McKinley, and others. Of the 138 miles within Yosemite, the federal government had only built eight, despite the collection over the years of over \$310,000 over the years in \$5 entrance fees.²¹⁶

Senator Phipps understood the post-World War I United States Treasury's position of trying to save money in every sector. However, he felt money paid by park visitors should be used to maintain or improve the roads. In his appeal for passage of the 3-year \$7,500,000 appropriation, Phipps urged:

Senators, this matter of adequate roads for the parks is not a selfish, a local, or solely a western issue. The parks are widely scattered and the number of visitors affects travel in every State of the Union. But that, possibly, is incidental. The proposition is this: The Congress, representing the will of the Nation, has created these parks for the use, enjoyment, and benefit of all its people. This was extremely wise, as no investment could yield better returns in improving the health and quality of our citizenship, in

promoting that unity of national feeling, that love of country, called patriotism. Having already taken this step, will the Congress now deny, to a large extent, the means whereby the parks may be used and enjoyed? We have given deserved recognition to the importance of other road work in all parts of the country. We have provided liberal Federal contributions for post roads, for farm-to-market roads, and for connecting links in a comprehensive program, national in its scope. We have also constructed needed highways in our national forests. That these appropriations were prudent and that work should continue, experience has already demonstrated. Now, Mr. President, there is one thing lacking. One well-nigh forgotten class of Government reservations should be connected up with the other highway chains already authorized. We must remember our national parks.²¹⁷

In summer 1923, President Warren Harding and a party of eighty, including future president Herbert Hoover and future Secretary of the Interior Hubert Work, visited Yellowstone and a number of other western parks. President Harding was moved by the visitors to the park and several times told Superintendent Albright that "Yellowstone revealed a cross section of the people of America." He was the third American president to visit the park and the first to travel by automobile on the road system. During the visit, Director Mather discussed the park roads bill, to which President Harding replied, "Don't worry, I'm the boss." However, Harding's unfortunate death prior to his visit to Yosemite caused concern for the bill supporters. They felt they would have to begin again convincing the new president, Calvin Coolidge of its importance. Fortunately, Coolidge supported the bill, and in the spring of 1924, it passed.²¹⁸

Meanwhile, in 1923 Mather faced problems of insufficient funds for improvement or construction in the parks. Since the creation of Yellowstone, \$3,042,300 had been appropriated for the roads in the system, with Yellowstone receiving \$1,482,000 during the Army's presence. Despite Mather's acknowledgement that Yellowstone's roads were better than any other park's, the excessive numbers of visitors caused rapid deterioration of the system. This was heightened by the fact that most of the money had been spent building wagon roads and not roads suitable for motor vehicles. Consequently, many were too narrow with excessive grades and the road base and surfaces were inadequate for motor vehicle travel.

Concerning the construction and extension of park roads, Mather held that:

all our roads should [not] be constructed on the most up-to-date road construction standards, but rather that each park road should be studied carefully with a view to its construction on grades and of material that will best suffice for its particular need; but all park roads should be full double width where possible to accommodate conveniently two-way travel. . . . We must guard against the intrusion of roads into sections that should forever be kept for quiet contemplation and accessible only by horseback or hiking."²¹⁹

Mather was opposed to the proposed new road across Bighorn Pass, which would run along the Gallatin River and down Panther Creek, joining the road from Mammoth Hot Springs to Norris. He insisted "We must keep a large area of Yellowstone in a state of untouched wildness if we are to be faithful to our trust as protectors of the wild life [sic] with which the park abounds."²²⁰ However, the director did support the government rebuilding the northern approach road through Yankee Jim Canyon, which had been requested by Montana officials for some time.

During the 1923 season, which registered a 40 percent increase over the previous season, general improvements of widening, surfacing, and sprinkling were carried out. Construction of log and stone guard rails and walls was completed. Two small sections of new roads were built in order for visitors to bypass the permanent camps at Lake and to connect the Mammoth camp with the Buffalo Corral road. A 16' x 26' log mess house and a 16' x 30' log stable were built at the Lewis River road camp.²²¹

By the end of 1923, the possibility that the proposed \$7.5 million appropriation would pass was favorable, and this placed new planning demands upon the National Park Service. Acting Director Arno Cammerer felt the Civil Engineering office should be moved from Portland, Oregon, to Denver, Colorado, where a more centrally-located office would make communications with the field and Washington more convenient. He felt the road construction responsibility for Yellowstone, Yosemite, Mount Rainier and Crater Lake should be given to the park superintendents, each of whom he believed was either a "tested road builder himself or had such talent available."²²²

CHAPTER VII

THE BEGINNING OF THE NATIONAL PARK SERVICE
ROAD PROGRAM 1924-1925

Before long the rain began to fall, and as the roads were soft clay they soon became very slippery and we had to put on our chains to avoid a serious accident. Even then it was difficult driving on those steep, narrow, winding roads, and we made very poor time, the car just crawling along on low or second gear for hours at a stretch. In places we had to stop and wait for a passing car or truck to extricate itself from the mud, and considered ourselves fortunate that we were not ditched ourselves.

--Mary Crehore Bedell, *Modern Gypsies*,

1924

In February 1924, the House Committee on the Public Lands held hearings on H.R. 3682, a bill authorizing the construction, reconstruction and improvements of roads and trails in the national parks under the jurisdiction of the Secretary of Interior. National Park Service Director Mather, Yellowstone Superintendent Albright, and M. O. Eldridge, Secretary of the Good Roads Board of the American Automobile Association, were among those who testified. Mather felt this legislation was the most important to be considered since the 1916 Organic Act that created the National Park Service. Albright explained the three-year plan would enable the National Park Service, which had a total of 1,060.5 miles of roads, to reconstruct 391.5 miles, surface 353.6 miles, and construct 360.85 miles. He further explained that expensive paving was not part of the program, except for 28 miles through Yosemite Valley. All the surfacing would be crushed rock or gravel, with a small section of bituminous macadam.

Albright believed that, in most cases, the roads were not ready for paving. Since most had been built for animal-drawn vehicles, they would need widening and curvatures and grades corrected for automobile use. Albright told the congressmen that the National Park Service would have to come back to them some time in the future for paving monies. In comparison to state roads, he stated that most park roads in Montana, Idaho, and Wyoming were unpaved. Albright testified that the three-year, \$7.5 million project would provide good curvatures, proper widths and grades and thus a good base for later paving projects.

Eldridge told the committee that the American Automobile Association had consistently supported appropriations for park road construction and improvements and strongly supported the impending bill. He related that the late executive chairman, A. G. Bathchelder, had been appointed by Secretary of Interior Franklin Lane to serve on a commission to assess the question of whether automobiles should be admitted to national parks. The commission also had written the initial rules and regulations under which automobiles could be admitted into Yellowstone.²²³

Mather felt the passage of the authorization bill in April 1924 reflected the "will of the people in demanding that the roads in the national parks be placed in a good and safe condition for motor travel." The first appropriation fell short of the expected \$2.5 million due to the Treasury having to pay for the Adjusted Soldiers Compensation Act. The initial \$1 million appropriation came with the request from the House that this money be used to bring existing roads up to safe and comfortable traveling conditions. However, they did promise that appropriations for the second year would come early in the spring so new construction projects could get underway. The deficiency of the first appropriation resulted in little work being authorized for 1924 in Yellowstone.²²⁴

However, one of the major accomplishments for 1924 in Yellowstone, but not financed by road money, was the construction of a combined checking and ranger station at the West Entrance. The log-trimmed frame building was the idea of the chief ranger, who supervised its construction. A temporary station, similar to the West Entrance Station, was also built at the East Entrance until a permanent building could be designed and built. A new 1,300' road was built near the Old Faithful permanent camp and the old road was abandoned. A new log-trim frame bunkhouse was built for the road camp at Dunraven Pass.²²⁵

Probably the most important thrust during 1924 was roadside cleanup. Albright and the Yellowstone Park Hotel Company agreed to a three-year plan of reconstructing all utility poles and lines throughout the park, using only one set of poles. Prior to 1924, the government ran its telephone or other lines on one side of the road and the hotel company ran its down the other side. During 1924, the lines and poles were removed on the Mammoth Hot Springs to Norris road and new joint lines and poles were reerected in a swath cut through timbered areas away from the road. In the open areas, the lines and cedar poles were placed farther away from the road and preferably on the side of the road with more inferior scenery. Albright's wish, "If we now had the means to clean up the roadside of the Yellowstone, this park

would be in first-class condition so far as its landscape protection is concerned," was soon fulfilled.²²⁶

A visit to Yellowstone by John D. Rockefeller, Jr. during the summer of 1924 had several implications for public enjoyment of the park. The first, and the one with the most immediate effect, was his assessment of the condition of park roadsides. Upon his return to his summer home in Seal Harbor, Maine, he wrote Albright thanking him for the kindness shown to him on his trip, but also stating, "There was just one thing in the Park which marred my enjoyment of that wonderful region, and I have wondered if I might be helpful to the Park administration in improving that situation. I refer to the vast quantities of down timber and stumps which line the roadsides so frequently throughout the Park." Wishing to remain an anonymous donor, Rockefeller went on to offer suggestions for cleanup and financial backing for a park-wide roadside cleanup project.²²⁷

For the next few months, correspondence flowed between the East Coast and the park, with Albright making estimates and Rockefeller offering suggestions and sending the first of many checks to cover the cost of the cleanup operation. Albright explained to Rockefeller that both he and Mather had been concerned about the roadsides since their 1915 trip to the park. Both had discussed cleanup with the Army officers at that time, but the Army estimates "almost paralyzed us but we took them at their face value."²²⁸ He stated that since the National Park Service took over the administration of the park, the grim financial situation had never allowed any cleanup other than picking up firewood for use during the winter. Albright had brought up the situation to some congressmen and several subcommittees, but to no avail. He said the congressmen felt there were too many more pressing needs than cleanup.

In September, Albright and Park Engineer A. W. Burney made a careful inspection of the road between Mammoth Hot Springs and Norris Junction in order to assess the amount of work needed on any given area on this section and to estimate the cost of cleanup. It had been decided that this section was the worst in the park and should have priority, particularly since this was also the first for telephone poles and lines relocation. Albright felt that the public image of the park might improve since part of this section was in the area of the 1883 forest fire that burned through a Douglas fir forest extending from Terrace Mountain in the west to Bunsen Peak on the east. While a portion of this burned section reforested soon after the fire, much of the route through which the road ran remained scathed. Many of the burned trees had been used for lumber in the building of Fort Yellowstone and the Mammoth Hotel. Thus for over thirty

years, stumps remained near and in the view of the road south of Mammoth Hot Springs. Albright feared that visitors would misinterpret the situation and assume that government policy allowed the operation of sawmills within the park to provide lumber for park buildings and perhaps even for shipment outside of Yellowstone. Albright and Engineer Burney recommended stump clearance from 200' to 500' away from the road's edge "in order to restore a condition that could be regarded as natural."²²⁹

Rockefeller sent Albright a check for \$1,000 to cover the experimental project and indicated that more money would be forthcoming based upon its success.²³⁰ The cleanup operation began in September, with Albright and Burney personally supervising a crew of three laborers, a cook, two teamsters, and a truck driver under the direction of a foreman. The crew was equipped with a camping outfit, three 1/2 ton dump wagons, chains, axes, shovels, etc., and began at a point approximately eight miles south of park headquarters. The amount of cleanup ranged from 50' to 60' on each side of the road. The crews hauled away all dead and down timber, brush, debris, etc. Dead standing trees within 10' to 15' of the roadway were cut down and removed. Other dead trees farther away from the road were left standing, unless they were about to fall down or were an impairment to the landscape.

As the work progressed, Albright formulated an estimate of \$14,430 for the heavy and light cleanup of the entire Mammoth Hot Springs to Norris Junction section. He hoped to have an estimate for the entire park road system by the opening of the 1925 season.²³¹

In fall 1924, Rockefeller not only sent additional monies, but personally involved himself with cleanup procedures. He suggested that hauling costs could be lowered if the dead trees, stumps, brush, and debris could be piled and burned. He also favored the removal of dead trees farther than 15 feet from the roadside.²³² Albright agreed with Rockefeller's suggestions.

In a November letter to Rockefeller, Albright announced that the eleven-mile section from Mammoth Hot Springs to Apollinaris Spring was:

as clean and beautiful as any similar stretch of road in the western part of the United States, except perhaps where millions have been spent on landscape improvements such as along the Columbia River Highway. I can truthfully say that the results we are obtaining in this cleanup work are beyond my expectations. Truly, no more important work has ever been undertaken

in this park than the landscape improvement that you have authorized and I find that I personally am getting more pleasure out of supervising this work than almost anything else I have undertaken.²³³

In addition to the overall landscape improvements, Albright felt the improved appearance impressed the road crews to such an extent that their previous attitude toward the roadside would be changed. Prior to the cleanup, the crews tended to cut trees along the roads and trails for use in repair work on the bridges, culverts, and buildings, and dig gravel pits along roadways. The cleanup project also prompted Albright to instruct road crews to include cleanup and maintenance of the roadsides as part of their normal duty. The new duties included removal of the old gravel pits along the roads.²³⁴

Also during the summer of 1924, Mather requested Albright's views on the Bureau of Public Roads assuming road construction and improvements in the parks. The day after receiving Mather's telegram, Albright responded in detail with his opinion:

1. The standards of the U.S. Bureau of Public Roads are extremely high, making road work very costly. Should we adopt the standards of the Bureau of Public Roads, our fund of \$7,500 would not build half as many miles of new roads, nor improve half as many miles of old roads, as we expect to build and improve. Furthermore, our standards call for retention of curves in order to avoid deep cuts and more or less unsightly fills and often extensive destruction of timber, whereas, the Bureau of Public Roads standards call for elimination of curves wherever possible and straight roads.

2. The Bureau of Public Roads up to the present time has not had supervision in its road building from landscape engineers. If it performed our road work it would have to establish a special division of landscape engineers. We have such a division at the present time. Lack of landscape engineer is responsible for the cutting of the right-of-way into the Calaveras Grove of Big Trees which resulted in the loss of one of the biggest sugar pines in California, as set forth in articles and pictures regarding the recent visit of Director Mather and myself to the Calaveras Grove.

3. The Bureau of Public Roads is a big organization, but does not have sufficient engineers to take over our work. That Bureau would have to add just as many engineers to supervise our work as we ourselves would

have to add to our organization, and in addition our appropriation would have to bear a portion of the overhead of the Bureau of Public Roads, which has a higher overhead than ours.

4. In certain parks, such as Yellowstone for instance, most of the road work which will be done under the new appropriation, can be handled under the supervision of the regular engineering organization. In other words, we have to have engineers here all the year round to plan and carry out maintenance work and these men can also supervise what construction we have to do. This observation applies to several parks.

5. Much of our road work will be improvement of existing roads such as widening, improvement of grades and surveying. This work will have to be carried on while the tourist season is in full swing. Such work will have to be done by force account and should be done under our direction because we will have to control the traffic and enforce our rules and regulations with reference to the use of the road during the time that the construction work is in progress. We had an example last year on the West Yellowstone approach road from Ashton, where the BPR let a contract for surfacing this main approach and through the summer tourists were routed over atrocious detours and complaints were myriad.²³⁵

Albright explained the U.S. Forest Service was also opposed to the Bureau of Public Roads continuing their road work. He then detailed conditions under which the Bureau might be allowed to administer the road construction program.

1. The Secretary of the Interior be empowered to absolutely fix:

- a. The standard of the road
- b. The amounts to be expended on any given project
- c. To have equal voice with the Secretary of Agriculture in the fixing of overhead charges against park appropriations.

2. That the National Park Service Landscape Engineering Division have full authority to pass on all survey and specifications before contracts were let and to supervise the landscape end of the work after contracts had been awarded.

3. In parks where the regular engineering organization necessary to properly maintain the park is fully qualified to perform the road work, then the Secretary of the Interior should have power to permit these organizations to do all road work in their respective parks by and with the general advice of the engineers of the Bureau of Public Roads.

4. That for the first three years' program the appropriation should be not less than \$100,000.²³⁶

Albright concluded by adding that if the above conditions were met, he would have no problem with the Bureau assuming the road construction and improvement programs in the national parks. He spoke very highly of his friends, Bureau Chief Thomas McDonald and his deputy, Dr. Laurence I. Hewes.²³⁷

Before the end of 1924, Albright found out that a little less than \$1 million was being spent on the approach roads to Yellowstone National Park. Most of the funding had come from the federal road aid and Forest Service appropriations and a smaller percentage from the states of Montana, Idaho, and Wyoming. Most of this work was done within fifty miles of the park boundary on roads primarily used by tourists to Yellowstone. Albright noted that since the Army left the park in 1918, Yellowstone had received \$60,403.32 for road improvements (widening at Dunraven Pass and surfacing of the south entrance road) compared to anywhere from \$500,000 to \$750,000 by surrounding states for improvement of old roads and the construction of some new sections. Albright found the figures very discouraging. In the past, the road system within the park had outshone the free approach roads. However, the latter were becoming far superior to the fee-collected intra-park roads which Albright called "really toll roads". He warned Mather that "nothing but criticism can be expected by Department and National Park Service officials from people who will have to use our roads."²³⁸

The approach road situation worried Albright and prompted him to request a report from Engineer Burney on the feasibility of the National Park Service assuming responsibility for construction and maintenance of the approaches to Yellowstone National Park. Albright concluded the most pressing problem was the sixty-mile north approach from Livingston to Gardiner, Montana. This section, designated by the Montana State Highway Commission as part of its state highway system, could have received money under the Federal Aid Road Act; however, the county's share would have been 47 percent. With Park County having nearly 700 miles of roads and 28 large bridges to maintain on a \$40,000 per year budget, the outlook for the Livingston to Gardiner section was

dim. Of the 700 miles of Park County roads, 103 miles were designated as part of the National Park-to-Park Highway system, and 35 miles of it north of Livingston were presently under construction. The construction of the 35-mile section was funded under the Federal Aid Road Act and the State Highway Commission. Park County's share was raised by bonds, and the county was in no position to take on further road projects for a long time.

Albright believed the Forest Service should take care of the 3 1/2 miles of the approach road through the Gallatin National Forest, but that the National Park Service should be responsible for reconstruction and maintenance of the 18-mile section from Gardiner through Yankee Jim Canyon. The canyon section was in dire need of reconstruction to correct the dangerous, steep grades, sharp curves and narrow road widths. Bureau of Public Roads engineers estimated that the reconstruction of the 18-mile section would cost \$314,000. A section south of Livingston had recently been reconstructed and given a crushed gravel surface.²³⁹ This program did not go unnoticed nationally. Shortly after Engineer Burney's report, H. R. 8882, a bill authorizing the construction of approach roads to national parks and monuments, was being prepared to be introduced to the House of Representatives by Congressman Scott Leavitt.²⁴⁰ Six years later, appropriation bills backed by Congressman Leavitt awarded \$10 million dollars to the National Park Service, with a portion designated for approach roads to the parks and monuments.²⁴¹

CHAPTER VIII

THE BUREAU OF PUBLIC ROADS AND THE NATIONAL PARK SERVICE

"A splendid working agreement."

--Stephen Mather, 1928

There was considerable debate in 1924 and 1925 over the advantages and disadvantages of the Bureau of Public Roads taking over the responsibility of road improvement and road construction in the national parks. In a 1924 report, Horace Albright spoke highly of the Chief of the Bureau, Thomas McDonald and his deputy, Dr. L. I. Hewes, but was not in favor of the Bureau assuming the road work in the parks. He felt that since National Park Service road standards were lower than those of the BPR, the parks would get more roads for the money. Also, the Park Service could better protect the park landscape and build roads at a lower cost due to lower National Park Service overhead. However, by April 1925, Albright concluded that for the following reasons, it might be advantageous for the BPR to take over the roadbuilding programs:

1. [NPS Chief Civil] Engineer Goodwin cannot co-operate with the park superintendents, and is out of harmony with some of Director Mather's policies. It appears that he must be replaced anyway.
2. Roads built to Bureau of Public Roads standards will be on a par with approach roads to the parks, will be safe for all park travel, and be constructed for all time to come, while roads on other standards will ultimately have to be improved.
3. It will be vastly easier to obtain future road funds under General Road acts, and with the close of the 1927 fiscal year, the National Park Service and the General Road authorities expire.
4. The Bureau of Public Roads have all of the best road engineers available to the Federal Government. We would have to offer higher salaries to get their men or to entice men away from the states.

5. The Bureau of Public Roads has been building roads for nearly ten years, and as one of their men recently told me, 'They have made all the mistakes it is possible to make, and that they know how to build without making so many mistakes, at least mistakes that a new organization would make.'

6. The Bureau of Public Roads will probably be transferred to the Interior Department under the present plan of departmental reorganization, so ultimately it is likely that the Bureau will take over our road work anyway.²⁴²

In his recommendation for the changeover, he stipulated several conditions:

1. To revise the three-year road program to conform to Bureau of Public Roads standards in general.
2. To turn over National Park Service road improvements to the Bureau of Public Roads.
3. To have the Bureau of Public Roads survey all projects and plan future roads.
4. To abolish the National Park Service office in Portland.
5. To work out a plan of cooperation with the Bureau of Public Roads that will continue authority in the Interior Department to:
 - a. Approve projects and areas to be opened to roads.
 - b. Control protection of the landscape.
 - c. Continue all maintenance and repair work, and where practicable to improve or build roads by force account under park engineers.²⁴³

Whatever Albright might have recommended, by 1925 Stephen Mather evidently became determined to have the BPR take on the park road program. Mather had brought the BPR into the picture a year earlier, when he had the agency survey and construct the transmountain "Going-to-the-Sun Road" across Glacier National

Park. Pleased with BPR Senior Highway Engineer Frank Kittredge's efforts there and by Dr. Howe's presentation at the 1925 National Parks Conference at Mesa Verde, Mather decided to let the BPR take over all major road construction projects in the parks.²⁴⁴

One of the first changes to occur at the national level was the reorganization of the NPS Civil Engineering Division. Chief Civil Engineer George E. Goodwin was relieved of his duties by Secretary of the Interior Dr. Hubert Work on 1 July 1925. Goodwin's assistant, Bert Burrell became the Acting Chief Engineer. In 1926, the Civil Engineering Office was moved from Portland, Oregon, to Yellowstone National Park, remaining there until its relocation to San Francisco on 1 October 1927. Bureau of Public Roads Engineer Senior Highway Engineer Kittredge was then named the Chief Civil Engineer with Burrell as his assistant. In the following year, 1928, the San Francisco office was designated as the National Park Service's Field Headquarters. Both the Civil Engineering Division and the Landscape Architecture Division (newly renamed from Landscape Engineering) moved to the Underwood Building in San Francisco.²⁴⁵

In July 1926, the National Park Service and the Bureau of Public Roads signed a memorandum of agreement relating to the survey, construction, and improvement of roads and trails in the national parks and national monuments. Mather called the document a "splendid working agreement." He believed that the landscape division would be "indispensable" to the Bureau of Public Roads in their joint effort "where scenery must be conserved and at all costs left as little scarred as possible."²⁴⁶

Daniel R. Hull, Chief of the Landscape Engineering Division, could not have agreed more. Even before the National Park Service and the Bureau of Public Roads signed the agreement, Hull found that his division devoted a "larger portion of time than ever before . . . to landscape protection in connection with the road construction program."²⁴⁷ The division's specific duties included

inspection of the territory before survey is made, going over preliminary road lines with the idea of suggesting modifications for the protection of landscape features or to take advantage of some scenic point which had been previously overlooked, and inspection on the ground during actual construction for the purpose of adding in the best means of carrying the program forward, particularly with an idea of making the finished result the best possible in its relation to the landscape. Bridges in connection with the road

projects have received considerable attention." ²⁴⁸

In 1925, the civil engineering department maintained 291.8 miles of road in Yellowstone National Park, 28 miles in the adjacent Shoshone National Forest and 30 miles in the Teton National Forest. Throughout the travel season, 107 miles of roads were sprinkled twice daily. Of the thirteen projects proposed as a part of the first three-year road improvement program, five were planned for completion or near completion in 1925:

1. Lake Shore Road--reconstruction of the eleven-mile stretch of road along Lake Yellowstone between Bridge Bay and West Thumb--replaced a steep, narrow, and uninteresting section.
2. Firehole River Road--widening the 1 1/2 mile section along the Firehole River, south of the Firehole Cascades--would allow two-way traffic.
3. West Thumb to Arnica Creek Road--widening a 3/4-mile section of road over Bluff Point, two miles from West Thumb on the Lake Road.
4. Mammoth Hot Springs to Tower Falls Road--widening a 1 1/8-mile section and surfacing a three-mile section between the 2 and 5 mile posts from Mammoth Hot Springs.
5. Inspiration Point Road--reconstruction of a 2 1/2-mile section along the north rim of the Grand Canyon. ²⁴⁹

The 54' steel bridge removed from a Gardner River location in 1919 replaced an old log span over Crawfish Creek. The steel bridge, placed on concrete abutments, was a 15° skew structure and its placement allowed the road to be straightened at the bridge crossing. Other bridge work included painting 23 steel bridges with paint composed of 15 percent sublimed blue lead, 10 percent silica and 10 percent zinc, 20 percent pure chrome yellow, 35 percent white lead and 10 percent National Park Service green coloring ground in pure linseed oil. ²⁵⁰

In autumn 1925, park engineers completed preliminary surveys of an eight-mile stretch between Turbid Lake and Sylvan Pass on the East Entrance road and an eighteen-mile section north and west of Grayling Creek on the West Gallatin road. ²⁵¹ The National Park Service expected the Bureau of Public Roads to conduct reconnaissance surveys on the Canyon Junction to Tower Junction road, the Tower Junction to Mammoth Hot Springs road, from

Fishing Bridge to Lake Butte on the East Entrance road, the Norris Junction to Madison Junction road, and the Lake Junction to West Thumb road.²⁵²

The working season of 1926 was especially trying for Superintendent Albright. In addition to the transfer of responsibility for the road work to the Bureau, Albright faced problems with independent contractors trying to complete small jobs within the park. The Inspiration Point road in particular illustrated the unsatisfactory working arrangement with contractors on small projects. Albright felt the park road crews could have completed the project on time. Since many park projects were small in scale, larger contractors often did not bid. In the case of the Inspiration Point road, a nearby contractor, Pioneer Construction Company, was awarded the work, despite the fact they did not have the equipment or any engineers. In the end, park road crews worked on it at the contractor's expense. Albright feared that the Bureau would be faced with similar problems.²⁵³

With prospects of an expanded road program lasting many years, another issue was housing for work crews. Road camp facilities were examined and tentative proposals offered for improving the situation. In the Mammoth Hot Springs area, workers were housed in several locations. One unwinterized building had seven private rooms and a dormitory configuration large enough for fifteen iron bunk beds. The truck drivers, barn men, commissary employees, and others occupied fourteen small rooms over the old carpenter shop. These cubicles were heated by individual stoves which consumed large quantities of fuel. Three men lived in one end of "McFarland's" shop without benefit of washing or bathing facilities or toilets. The park proposed to build additional quarters for single, permanent employees and to partition the carpenter shop into more rooms and a bathroom. At Beaver Lake, the existing log mess house and frame stable were repaired and a new frame bunkhouse for ten men was added. At Norris, the large and unsightly frame mess house was earmarked for replacement. The log and frame stable and frame bunkhouse both needed painting or staining, and two small frame buildings needed relocation to a less conspicuous place. At Gibbon Meadows, the log stable and frame mess house were sufficient, but a new twelve-man bunkhouse was recommended for Madison Junction. The frame mess house and log storehouse there were adequate, but because more motor equipment was needed in this area, the stable located in one end of the storehouse could be dispensed with. At Excelsior Geyser, a bunkhouse addition was recommended for the frame mess house and log stable complex. At Old Faithful, the frame mess house and frame officer's house complex needed a frame bunkhouse for camp cleaners, sprinkler man, and truck driver, and a frame stable for

the cleaner's team and the ranger's horses. A frame mess house and bunkhouse, small frame house for the cook and a frame stable was required at Spring Creek. Nothing more was required at DeLacey Creek. At West Thumb, it was recommended that the frame mess house and bunkhouse located in the auto campground be torn down and a new unit and stable be built on the hill south of the campground. A frame granary and a log and slab shed for a stable were also located in the auto campground.²⁵⁴

At Lake, it was recommended that the log mess house be remodeled to add a cook's quarters, and that the log bunkhouse be remodeled or a new one built. A new stable was required, and the old sheds in the area were to be razed. At Trout Creek, it was suggested that the frame stable be razed, and a smaller one and a frame bunkhouse be built. At Canyon, the log mess house had to be enlarged to include a cook's quarters and a new bunkhouse was to be provided for fifteen men. The Dunraven Pass frame mess house, frame stable with log trim and frame bunkhouse with log trim were considered adequate. At Tower Junction, the old log stable had to be razed and a smaller one built behind the mess house, and a log or frame bunkhouse had to be built. At Blacktail Deer Plateau, the old log mess house and log stable was to be razed and a new complex of mess house, bunkhouse, and stable built nearer the road. At Virginia Meadows, a small log or frame bunkhouse and stable needed to be added to the existing log mess house. At West Gallatin, a log mess house and log bunkhouse would be needed after the road was completed. Complexes containing a mess house, bunkhouse, and stable needed to be built at Lamar Canyon and at Devils Well on the Cooke City road. A frame or log mess house, bunkhouse, and stable were needed at Turbid Lake and at the East Entrance, and a bunkhouse addition to the log mess house and log stable at Lewis River. Facilities at Cub Creek were adequate.²⁵⁵

The first five projects of the three-year plan were completed in 1926. The work along the Firehole River between Madison Junction and the Firehole Cascades was "constructed on the highest standards of any used in the National Park Service" since "the beauty of the canyon justifies the very great attention that is being given to details of wall and fill construction." The maintenance staff painted five bridges including the Gardiner River and Yellowstone River bridges on the Cooke City road National Park Service green. The Lamar River bridge was realigned and repaired and the Lava Creek, Blacktail Deer Plateau and Gardiner River bridges redecked. The park and the Yellowstone Park Hotel Company continued the telephone line

relocation project with removal of lines between Norris Basin and Old Faithful that year. The landscape architects worked very closely on this project, particularly where vista cutting was required.²⁵⁶

The Rockefeller-funded cleanup operation completed the Mammoth Hot Springs to Norris Junction section with crews working out of the road camp buildings at Beaver Lake, a tent camp set up in the public campground at the 16.5 milepost near Twin Lakes, and a camp at Norris Junction. Due to the high fire risk, the piles of debris were left for the rangers to burn later.

In June, a crew worked out of Lake Camp on the Bridge Bay section, and in September, from the road camp at West Thumb. In September, crews working the Lake to Canyon road found the slopes of the Cascade Creek Canyon just below the Canyon Hotel and the canyon west of the ranger station steep and difficult to work. Stump removal on all of these sections was done with blasting and/or with Holt tractors. By the close of the 1926 season, Rockefeller had given \$22,368.37 toward the cleanup of 31 miles of Yellowstone roads.

Park crews using government funds continued work on the Lake Shore road by cleaning up the shoreline and cutting vistas at specific points. They removed old slashings that had been dumped over the rim at Canyon, cleaned up the road to the Canyon bear dump behind the hotel, and removed old trees and stumps from the dump.

Reconstruction of the East Entrance road by park crews was scheduled to begin in September; bad weather, however, prevented any excavation, so the crews began clearing and grubbing. The workers found this to be the heaviest work in the park, due to the extensive piles of old slash along the road.²⁵⁷

John D. Rockefeller, Jr. visited Yellowstone in 1926 and was pleased enough with the progress to authorize more work for the next year. This project affected the entire national park system. Not only did Rockefeller offer aid to Crater Lake National Park, he also used his influence with Congress in support of the parks on this and other projects. Albright described the improvements in his 1926 annual report:

One must see the Yellowstone roadside improvements to appreciate what the work means to the park. The effects obtained are almost unbelievable. The mere removal of the litter constitutes a transformation, but after the snow of a winter and the following summer's sun have done their part,

one can hardly realize that the highway has not been removed to a new location. The grass and flowers among the trees and along the road present a truly park atmosphere that did not exist before that work was undertaken.²⁵⁸

Albright visited many western parks during 1926 and was impressed with the emphasis now placed on roadside cleanup. He expressed his gratitude to Rockefeller in a May 1927 letter:

I feel that we owe all of this interest in the improvement of our highways to your help in the Yellowstone. You started one of the most important movements ever undertaken in the national parks and the results obtained have attracted so much attention that there has been no difficulty in getting roadside cleanup recognized as an exceedingly important part of future road construction programs to be carried on by the Government. I only wish I could put down on paper and thus convey to you the interest and enthusiasm that I observed among park superintendents and road engineers for this roadside improvement work.²⁵⁹

Another road-related issue, still unresolved in 1926, was Albright's study of possible restoration of some of the old roads for use in fire protection. His intent was to make them passable for light truck use during the emergencies occasioned by big forest fires.²⁶⁰

With most of the three-year program projects completed, the park began planning for a new five-year program based upon a survey of all of the roads in Yellowstone with the exception of Cooke City and Mount Washburn roads and the assumption of a congressional appropriation of \$5 million per year (or \$25 million for a period of five years, servicewide). Yellowstone's share of the \$25 million would be \$3,240,000, or \$1,620,000 should the lower appropriation be approved. With these amounts, Yellowstone officials realized that only the worst road sections in the park could be reconstructed and that most of the old Army bridges would have to be retained instead of being replaced with adequate structures.²⁶¹

With the state highway departments completing roads of high standards near the park, the contrast with road conditions inside Yellowstone continued to be evident. Albright called the East Entrance road "one of the most dangerous roads in the national park system" and recommended its reconstruction as a high

priority. The road, with no parapet protection, grades up to sixteen percent, and widths in some places of only 8', was used by 105,000 travelers in 1927. Albright also called for reconstruction of the Gallatin Highway section and the road through Gibbon Canyon. In addition to the reconstruction work, Albright's other major concern was the continuing dust problem.²⁶²

Albright and Bureau of Public Roads officials knew that it would be at least ten years before the whole Yellowstone road system would be addressed, but the National Park Service planned to continue the experimental oiling program effort to eliminate the dust nuisance. Yellowstone's maintenance crew adopted the "California method, more particularly known as the 'Victorville' or the 'Bryceburg-El Portal' method". During the summer of 1927, the park received positive comments from the public about the use of oiling as a dust palliative. Maintenance crews oiled 124 miles of roads with from 1/9 to 1/2 gallons per square yard (or 300,000 gallons) of light oil in June, July, and August. Besides eliminating dust, the switch from water sprinkling to more successful oiling benefited the landscape by keeping roadsides and wildflowers looking cleaner and green. Another benefit was removal of the entire water sprinkling system, including the "eyesoires" or wooden water tanks along the roads.

The oil hauling operation used nine tank trucks and a distributing truck. Four of the tank trucks, which were World War I surplus, had steel ammunition bodies with steel plates welded and mounted on the backs to haul the oil.²⁶³

Removal of the wooden water tanks complemented the continuing roadside cleanup program. Throughout 1927, privately funded work concentrated on the road from West Thumb via Lake to Canyon. Roadside cleanup was also part of the road construction project from Canyon Junction to Tower Junction. The intent of this new road was to give the visitor "one last look at the Canyon before going over Dunraven Pass, and also to shut out the unsightly view that one sees from the old road, i.e., the backyard of the hotel, the transportation sheds, barns and buildings and old cuttings from previous logging operations."²⁶⁴

In 1928, Yellowstone's resident engineer, Merrill Daum, was named Assistant Superintendent and Cecil Lord was chosen to replace him; Lloyd Regnell was named Lord's assistant. The dust prevention program was augmented with six new White trucks with 1,000-gallon capacity insulated tanks, and a World War I surplus vehicle fleet for oiling the 180 miles of road. Approximately 500,000 gallons of heavy-duty road oil were hauled from the heating plant at Gardiner. While the heavier oil achieved better results in dust abatement, it increased public complaints about

its adhesion to vehicles. The park responded by having a road grader distribute sand and gravel on the freshly oiled surface. In the end, this produced a thicker more desirable mat.²⁶⁵

Three new road projects were initiated in 1928: Norris Junction to Madison Junction, East Entrance to Sylvan Pass, and the Grayling Creek section of the West Gallatin road. New road camp buildings were constructed at Madison Junction, Norris Junction, and Lewis River.²⁶⁶

Several landscape architecture issues loomed in 1928, the most serious of which was precipitated by a careless contractor's abusive use of explosives. The resultant destruction of trees, shrubbery, and telephone lines for a 1/8-mile segment along the Sylvan Pass to East Entrance road left a furious Superintendent Albright blaming the Bureau of Public Roads, the contractor, and the Landscape Division of the National Park Service for "an excellent example of the type of work which we do not want in the parks." Albright demanded a tightening of all new end hauling specifications and the approval of the Chief Landscape Architect for any excess material stored along points of work.²⁶⁷

Yellowstone's landscape architect supervised the effacement of some of the old, disused road sections. The roads were first plowed and reseeded. In addition, new NPS Chief Landscape Architect Thomas C. Vint suggested they be covered with manure to promote more rapid vegetation growth.²⁶⁸ He also requested that in the reconstruction or construction of roads "when we limb trees along the right-of-way for construction purposes or to improve the sight distance or similar reasons, he would much rather that we would fell the trees as he does not like to see trees covered with axe marks and minus limbs."²⁶⁹

By the end of 1928, the interagency relationship between the National Park Service and the Bureau of Public Roads was responsible for the survey and planning of reconstruction needs for approximately 1,500 miles of park roads with an estimated \$50 million tab. As of 1928, Congress had authorized \$17.5 million and had appropriated in cash \$15 million. Under the cooperative agreement with the BPR, 211 miles had been completed, an additional 103 miles were underway, and 61 miles would be started in 1929. BPR Senior Highway Engineer Frank A. Nickols wrote:

By reason of the rugged mountainous character of most of the parks, road construction in these areas involves engineering problems of more than ordinary difficulty, . . . the solution involves spectacular features which give to these roads high rank among the most interesting highways in

the world. In all the work done, close attention is given to the preservation of the natural beauty of the landscape. The Park Service sees to that. Heavy cuts are avoided by rolling grades and graceful curves which closely fit the topography. In making the side-hill cuts which are unavoidable the plans provide for future covering of the banks on the upper side with ferns, flowers, and shrubs, and the excavated material is not cast down on the lower side as in ordinary road construction but is hauled to locations where it can be disposed of without scarring the landscape. The existing tree growth is saved wherever possible. Bridges, faced with native stone, are designed to blend harmoniously with the natural surroundings; and the highways are designed in every respect to develop and give access to the natural beauty spots and to detract as little as possible from the undisturbed beauty of reservations. The roads are not designed as speedways but with the idea that they will be traveled at speeds which will permit observation of the scenery; and ample parking spaces are provided for more leisure study.²⁷⁰

The close of 1928 saw Yellowstone entering a new period. Horace Albright, who had served as superintendent longer than any other person (28 June 1919 to 12 January 1929) replaced Stephen Mather, who had resigned due to ill health, as Director of the National Park Service. Albright had assumed the administration at Yellowstone when responsibility for the road system was transferred from the Army to the fledgling Civil Engineering and Landscape Engineering divisions of the National Park Service. These were important times in the history and development of the road system, because Yellowstone was faced with the transition from a system designed and built for animal-drawn vehicles, to a road system used by the ever-increasing numbers of motor vehicles. Albright, as Field Assistant, had also assisted Mather in establishing the working relationship between the Park Service and the Bureau of Public Roads.

By the time Albright left Yellowstone, the park had an annual visitation of 230,984, of whom 183,565 arrived in 58,028 automobiles. Most of the others, 41,697, were rail visitors. The road system covered 305 miles--Grand Loop, 142 miles; the entrance and connecting roads, 79.6 miles; roads to certain points of interest, 83.4 miles. In addition to the intra-park system, Yellowstone maintained 32 miles of approach roads through the Teton National Forest and 28 miles of through the Shoshone

YELLOWSTONE ROADS AND BRIDGES
HAER No. WY-24
(page 99)

National Forest.²⁷¹

CHAPTER IX

THE MODERN ROAD SYSTEM IS SET 1929-1940

In all the work in the National Parks, the Bureau of Public Roads has been guided in its design by the Landscape Division of the National Park Service. Landscaping of highways is comparatively new in America, and the bureau has been fortunate indeed in having the effective cooperation of a splendid group of landscape architects. The landscaping of the National Park Highway System has as its essential aims the diminution of scars; the introduction of certain elements of grace in alignment; the use of architecturally pleasing structures; and the protection of trees, shrubs, and other natural growths from destruction and damage during construction.

--L. I. Hewes, Deputy Chief Engineer,

Bureau of

Public Roads, 1932

Roger Wescott Toll replaced Horace Albright as Superintendent of Yellowstone in February 1929. Prior to this new appointment, Toll served as superintendent at Mount Rainier National Park (1919-1921) and at Rocky Mountain National Park (1921-29), and had been actively involved in the extension of both parks' road systems. No major road projects were begun at Yellowstone during his first year, except one six-mile section between the East Entrance and Sylvan Lake. All other ongoing road projects were either completed or scheduled for completion before the 1929 season was over. The roadside cleanup project continued with Rockefeller funding the completion of 45 miles and the remaining 61 miles funded by the National Park Service. Between 1926 and 1929, some 300 of the 350 wooden sprinkling tanks had been removed along with other related sprinkling structures. Construction of buildings tied to road projects included the three-lane checking station at the East Entrance, a new road camp at Lake (mess house, twenty-man bunkhouse and three-stall stable), and a stable each at Canyon and West Thumb.²⁷²

On the national level, Director Albright called the building of highways "the most important construction project before the National Park Service." Several very interesting and challenging

projects were being undertaken in other national parks--the Zion-Mount Carmel Road in Zion National Park, the Transmountain ("Going-to-the-Sun") Road in Glacier National Park, the Generals Highway in Sequoia National Park, the Trail Ridge Road in Rocky Mountain National Park, and the Yakima Park Highway in Mount Rainier National Park.²⁷³

Albright's experience with roadside cleanup projects in Yellowstone, Lafayette (now Acadia), and Crater Lake national parks led him to become a spokesman for roadside improvement and scenic reserves across the country. In an article he wrote for the *Saturday Evening Post*, he described the efforts in California, Yellowstone National Park, and along the Columbia River Highway as good examples. He spoke of the stiff regulations imposed within the boundaries of the national parks regarding signs and the despoliation of the scenery, and commended the citizens of Cody, Wyoming, and Gallatin County, Montana, for their agreements to ban billboards and "roadside nuisances" along the approach roads. The town of Cody set aside a hill, known as "Signboard Heaven" to accommodate those who wanted to advertise, leaving the last sixty miles to the East Entrance free from clutter. County commissioners in Gallatin County appealed to private landowners to refrain from spoiling the Gallatin Highway leading into West Yellowstone and similar efforts were made along the highway from Livingston to Gardiner. In addition to billboards and signs, unsightly wayside stands marred the nation's roads during this period. Mrs. John D. Rockefeller, Jr. joined her husband in his crusade to cleanup roadways and roadsides, particularly those leading into national parks. She offered a generous annual prize for the best designed wayside stand, and organized a planning board of architects who would furnish designs for roadside stands free of charge.²⁷⁴

Reconnaissance survey work over the entire road system kept the Bureau of Public Roads busy during the early 1930s. In order to keep up with this planning effort and also with the National Park Service's new six-year plans, the Civil Engineering Division and the Landscape Architecture Division were both expanded. A second office, the Eastern Branch of the Landscape Architecture Division, opened in Yorktown, Virginia.

On a national level, the Bureau of Public Roads program was involved in 44 major projects in 1932 at an estimated cost of \$8,400,000 and the National Park Service supervised 82 minor roads and trails projects, for an estimated \$962,000. The minor roads and trails work were generally 1-year projects completed by day labor and paid for with cash allotments.²⁷⁵

The Landscape Architecture Division designed "an unprecedented number of bridges" for the Bureau of Public Roads projects and experimented with staining several concrete bridges to "harmonize with the predominate color of the surrounding landscape." In addition to bridge designs, the Bureau began to develop landscape plans for parking areas, sidewalks, and curbs. The Landscape Architecture Division expended major effort in designing (or adapting BPR designs for) bridges, gateways, and other buildings for particular sites. During 1931, standardized specifications for the rounding and flattening of slopes, and methods of blasting and removal of form marks were adopted. The Park Service landscape architects were concerned about lingering effects of road projects on the landscape and insisted that borrow pits, quarries, and abandoned road camps be restored or obliterated.²⁷⁶

In Yellowstone, plans were drawn for the Tower Falls Bridge, Seven Mile Bridge, Gardiner River Bridge, six bridges on the Red Lodge to Cooke City road, the Pilgrim Creek Bridge and the North Entrance checking station. Funds for the Red Lodge to Cooke City road and the Moran to South Boundary road were provided by special legislation, the Leavitt Approach Road Act of 31 January 1931, which authorized:

The allocation of not to exceed \$1,500,000 of the national park and monument road and trail funds for each of the fiscal years 1932 and 1933 for construction, reconstruction, and improvement of national park and monument approach roads which cross lands wholly or to the extent of 905 owned by the United States. As the primary value of these roads is to carry national park travel, and as they cross lands wholly owned by the United States, the cost of construction is properly being borne 100 percent by the Federal Government. The expedition of the construction of these approach roads will result in securing in the shortest possible time, the maximum usefulness of the road systems being constructed in the park.²⁷⁷

This act also funded the construction of the connecting road between General Grant and Sequoia and the Desert View to Cameron approach road to the Grand Canyon.²⁷⁸

In summer 1931, the park road crews and some of the BPR and contractor's crews were pulled off road projects to assist in fighting forest fires in Yellowstone. Even though the fires caused a slowdown, the Bureau accomplished more in Yellowstone that year than ever before. The Lewis River to West Thumb, West

Thumb to Arnica Creek, Bridge Bay to Mud Volcano (which included the Fishing Bridge and Lake Junction layouts), and Mount Washburn loop roads were completed. Different stages of construction were carried out on the East Entrance, Canyon to Tower, Obsidian to Firehole, Tower Falls to Blacktail Deer Creek, Mammoth to Obsidian and Moran to the South Boundary roads.²⁷⁹

Albright surveyed the Yellowstone road work again in September 1931. He was pleased with the progress of the interbureau relationship, remarking that "I had never seen the roads in better condition or the park in general in better trim than it is at the present time, nor can I recall that it ever had a more enthusiastic and capable group of employees than the permanent organization now in charge of its destinies."²⁸⁰

While complimenting the appearance and condition of the roads, he extolled the policy of keeping as much of Yellowstone as "wilderness unspoiled by roads, in many cases untouched even by man-made trails, the paths of animals having been cut out to provide routes for patrolling rangers."²⁸¹

Despite the Depression, travel to the national parks increased by 5.9 percent during 1931. Albright described the parks as being "a strong influence for stabilization and good citizenship." He felt "the true value of the parks was: 'clearly shown . . . by the fact that in a time of anxiety and restlessness, they (the parks) were immensely useful to large numbers of our people.'" Visitors praised the condition of the park's roads. By this time, the Grand Loop had received the palliative oiling treatment, thereby abating the dust nuisance.²⁸²

In July 1932, the American Society of Civil Engineers met in Yellowstone. Frank Kittredge, Chief Engineer of the National Park Service, delivered a paper entitled "Preserving a Valuable Heritage." He explained to the gathering that the Organic Act creating the National Park Service, mandating it "to conserve the scenery and the natural and historic objects and the wild life[sic] therein; and, to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations," presented a tremendous challenge to the Engineering and Landscape Architecture divisions. He said the government term "improvements" (construction projects of all types) could be a misnomer as many would feel "that Nature's work cannot be improved, and that anything man can do is destructive and hence not an improvement." In order to minimize the effects on the park, the road work was carefully planned. Kittredge felt that "a bridge will always look like a bridge no matter what attempts are made to blend it

into the surroundings or how much money is expended on it." Conceding this fact, he built many concrete and steel bridges throughout the system. However, the landscape architects promoted the use of masonry arch bridges that blended with the landscape as the most desirable type, particularly where "rugged landscape is the rule."

Kittredge drew the participants' attention to the fact that many "excellent bridges" had been built in Yellowstone, including two that were at that time considered outstanding engineering achievements--the concrete viaduct through the Golden Gate and the Melan-type arch bridge sited 1,000 feet above the Upper Falls of the Yellowstone near the Grand Canyon. Both of these achievements were the work of Army Corps of Engineers officer Hiram Chittenden. Kittredge believed that the "chief value of the parks to the nation is in their inspiration and educational features, and this fact must be recognized in making all improvements."²⁸³

Kittredge was followed by Dr. L. I. Hewes, BPR Deputy Chief Engineer, who delivered a paper entitled "America's Park Highways." He stated that with very few exceptions, such as the fifty miles between Williams, Arizona, and the south boundary of the Grand Canyon, most park roads and approach roads were in very rugged terrain and required heavy mountain type construction. As a general rule, the construction of the park roads was to a high standard of cross-section, alignment, and grade. Surfacing was to an 18' minimum, and in some cases, 20'. The sections in cuts were 27' wide and the ruling grades were generally five percent. However, some areas had a six percent grade and a few required a grade of seven percent. Hewes pointed out that every curve received careful attention and individual design. Recognizing that park roads were not primarily built for thoroughfares but for recreation, the engineers still had to consider safety and peak traffic load. Their philosophy also included the premise that "park highways now under construction are in their final location."

Dr. Hewes explained that in the construction of curves, "operating safety is never sacrificed to landscaping effects." The engineer introduced "long, carefully compounded curves with gradual changes in length of radii" to eliminate "broken back" curves.²⁸⁴ He said that all curves were designed to have "grade compensation, which is increased when the ruling grade is five percent or more." He told the group that grading and surfacing costs were averaging \$40,000 per mile and that plans were to use some type of bituminous topping on a minimum width of 20'. Saying that it was too early to evaluate the ultimate life of the surfacing (usually three inches of fine crushed material laid

over four inches of fine crushed stone, rolled into place), they had found the finish provided "excellent riding qualities" and could be scarified and relaid if necessary.

One of the other recent changes in park road construction had been the elimination of steep, narrow ditches and substitution of "a broad shallow type, which will be much safer for traffic and serve to increase the total driving width of the highway." In order to minimize scars in cuts and fills on park roads, engineers employed the more expensive techniques of "judicious use of riprapped embankments, and less frequently, by the building of retaining walls and careful design of the grade to permit end-hauling to invisible gullies."

Dr. Hewes also spoke of landscape considerations in bridge and culvert design, stating that wherever possible, arch bridges with concrete barrels and natural stone masonry were built. Because of their compatibility, use of arch bridge designs had been extended to crossings for which they would have hitherto been considered inadvisable, or in some cases, impossible. He cited the Mount Vernon Memorial Highway bridges as examples of some of those considered inadvisable, since they were constructed on silt. In addition to bridge design, he elaborated on the architectural details of culverts, stone walls, and pullouts, citing the preferred use of stone culverts or the construction of stone masonry head walls with pipe culverts and the use of cement rubble masonry guard walls.

In conclusion, he told the engineers that of the 1,800 miles in the national park road system, approximately one-third had been completed for an approximate cost of \$25 million. More importantly though, Hewes felt the National Park Service philosophy of what a park road should be had permeated to work beyond park boundaries and to many western state highway departments.²⁸⁵

Economic hard times continued to plague the country, but in 1933 automobile travel to Yellowstone again increased. Even though visitation rose, concession owners suffered heavy financial losses because tourists did not stay in the hotels or use the dining rooms. Showing a preference for camping, travelers also shortened their length of stay at Yellowstone. Park employees, including those on per diem, were also hit by the governmentwide fifteen percent cut in pay on 1 April 1933, a provision of the "Act to Maintain the Credit of the United States Government."

However, President Franklin Roosevelt's newly organized government relief programs benefited the national parks in many ways, including funding for different types of road projects.

Local road contractors used funds from the Emergency Conservation Works program to employ men from outside the park to work on Yellowstone roads in 1933. Two projects, the Tower Falls-Mammoth Hot Springs and the Golden Gate roads, provided employment well into the winter for many local men. The Golden Gate to Obsidian Cliff grading project was unusual in the history of the park road construction in that it continued during the winter months with only a two-week delay due to severe weather.

Under the Public Works Program of the National Industrial Recovery Act, Yellowstone received approximately one-fifth of the \$16 million allotted to the entire park system for road and trail work. Yellowstone's funding included \$2,531,400 for major projects, \$102,050 for minor projects and \$736,000 for approach road work. The Bureau of Public Roads awarded four contracts from this funding--surfacing of the sections from Tower Falls to Lava Creek and from Mammoth Hot Springs to Obsidian Cliff, grading from Bridge Bay to the Yellowstone River rapids and the Lewis River to Arnica Creek sections. This allotment to Yellowstone, the single highest amount of money received for road construction in the park's 61-year history, was one of Horace Albright's last official actions as Director of the National Park Service.

President Roosevelt's most popular relief program, the Civilian Conservation Corps (CCC), was authorized by an act of Congress dated 31 March 1933. Four camps were set up in the park in June 1933. The CCC projects included telephone line repair, bank erosion control, roadside cleanup, cleanup of old dump grounds and campgrounds, truck trail construction, fire protection, trail construction, landscaping, range improvements, reforestation, insect control, old fence removal, repair and building of new fences, removal of old buildings and fire suppression work.

During the year, the Bureau of Public Roads completed or nearly completed the grading between Tower Junction and Lava Creek, surfacing and oiling of the Canyon to Tower Junction section, grading of the Terraces to Obsidian Cliff section.

Yellowstone's maintenance staff now maintained 361 miles of road, 310 miles inside the park. About 120 miles of the Grand Loop system had been built to a highway standard, 74 miles of which were paved with crushed rock or gravel and treated with asphaltic oil. All roads in the park, except the Cooke City road, were given an annual oil treatment for dust prevention and maintenance for better surface conditions. Maintenance crews of between six and fifteen men now operated out of fifteen carefully selected locations in the park.²⁸⁶

In summer 1933, a change was made in road finishing. The new Director of the National Park Service, Arno Cammerer, requested that the painting of traffic stripes on curves be discontinued on all national park roads. Feeling that the centerline stripes had "an undesirable appearance in a national park," he recommended that the existing stripes be allowed to wear out and should not be replaced.²⁸⁷

The Bureau of Public Roads kept busy in 1934 awarding contracts for Yellowstone projects, for which nearly \$3 million of public works program funds had been allocated. The major focus was the improvement of the Grand Loop and the worst sections of the entrance roads. Superintendent Toll felt that within two or three years, the Yellowstone roads would meet modern standards and be "comparable to any of the highways found in the surrounding states." Park visitors complimented the "marked improvements," particularly the scenic highway through the Golden Gate.²⁸⁸

Two more CCC camps were set up in the park 1934, bringing the total to six camps with 225 men working on twenty different types of projects. CCC road projects during 1934, for the most part, were related to roadside cleanup on the Canyon to Norris section and along the Gibbon River just above Virginia Meadows, and bank slope treatment and road obliteration near Artist and Inspiration Points.²⁸⁹ Another roadside cleanup project, completed before summer's end, was the removal of old bridge abutments and ruins at Grayling Creek on the Gallatin road. Temporary Landscape Architect Walter Popham felt "considerable change had been effected in the appearance of the highway."²⁹⁰

In a November 1934 letter to NPS Chief Landscape Architect Thomas Vint, Superintendent Toll reiterated the goal of building roads that "will not have to be rebuilt." He called the "reconstruction of roads, and the unsightly abandoned roads . . . most detrimental to the landscape." Toll cited the demands that heavier traffic and larger vehicle size had on park road designs:

The size of bus units and trailers is steadily increasing. In passenger cars, the normal operating speed has increased greatly during the last decade. State highways are now built under and on better alignment than formerly. We do not aim to build speedways, but if we did not build roads that are comparable with highways throughout the country, the chances are that the roads will be rebuilt be-fore[sic] long. To avoid that possibility is of the greatest importance. The

loop road has two standards of width. As I recall it, the shoulder to shoulder width is 26 feet on some sections and 28 feet on other sections. . . . it would seem to be a serious mistake to adopt any standard of width or alignment less than the rest of the loop road. We would be forfeiting the considerable sum that has been spent to secure these standards If we do not build to acceptable standards, we will not get full value for the money spent.²⁹¹

Travel to the park (260,775 visitors) now exceeded the pre-Depression high and increased the 1933 figures by 61 percent. Maintenance crews increased the number of miles maintained by 21 miles, for a total of 382 miles, 328 of which were within the park boundaries.²⁹² There were now fifteen road camps within the park and one for each of the approach roads.

A major reconstruction of twelve miles of the East Entrance Approach Road was underway in 1935. In addition, major road reconstruction of 165 miles within the park encompassed several stages of construction--80 miles of grading, 29 miles of surfacing, and 56 miles of oil mat surfacing. The opening of the Red Lodge to Cooke City or Northeast Approach road necessitated the construction of a proper checking station at the Cooke City entrance to the park. The log station, constructed with Public Works Allotments funds, replaced older structures on the nearby abandoned road.²⁹³ Other public works road-related projects carried out in 1935 were improvements to the Lake Shore section of the West Thumb to Lake road, construction of two miles of 22' width roads into the Black Sand Basin, three miles in the Firehole Lake area, and a spur road near Sheepeater Cliff, replacing old dirt tracks.

CCC road-related work in Yellowstone continued to be mostly roadside cleanup and landscaping. Aesthetics remained a major concern of Superintendent Toll. He requested the BPR include a provision in all road construction or surfacing contracts for removing conspicuous stumps in view of the roads. He definitely wanted them removed at least up to 50' from the road's edge. He also suggested that as a part of road obliteration, border stones be placed over the abandoned roads.²⁹⁴

During these years of extensive road reconstruction and bridge building, the National Park Service wrote stringent specifications for special landscape features such as masonry guardrails, wooden guardrails, and stone paving. These specifications covered materials, construction, and treatment of

the features. Other special construction actions such as blasting and cleanup procedures were addressed. In some cases, contractors were required to build sample masonry guardrail sections for approval by the park engineer or landscape architect. Wooden guardrails for the most part followed the Standard Specifications for Forest Road Construction, Form F.R. 50, Revised 1932, with additional requirements regarding the cutting of timber and preservative treatment.²⁹⁵

The road width issue fell somewhere between the safety and aesthetics factors. With increased automobile travel to Yellowstone, the question of safety played a major role in Toll's acceptance of the earlier decision by the National Park Service and the Bureau of Public Roads to have a standardized 28' width, shoulder to shoulder, for the Grand Loop and 26', shoulder to shoulder, for the other roads. This allowed for a paved width of 20' and either 4' or 3' shoulders, respectively. Toll was aware that the disadvantages of the wider roadway would be a more noticeable wider clearing, higher cuts and fills, and greater costs. The advantages, however, were better support for the paved surface, less risk of accidents for automobiles parked off the road, more room for snow disposal, and a safer road in general. Toll knew the Bureau of Public Roads had been building to a higher standard, including the building of 30' width roads on California state and national forest projects, with the anticipation of similar proposals for the states surrounding Yellowstone. Toll concluded the wider roads would "prove economical in the long run. They are safer and more satisfactory to visitors."²⁹⁶

In February of 1936, a tragic automobile accident near Deming, New Mexico, took the lives of Superintendent Toll and the Chief of the NPS Wildlife Division, George Wright. The accident left a void in the service, especially at a time when the Wildlife Division was in its infancy and the park system was in a growth period. In Yellowstone, the road program was in full swing with 199 miles of roads under some form of reconstruction and the construction of some of the major park bridges underway. Additional work was done on the secondary road in the Firehole area, and the grading and surfacing of the three-mile road from near Fountain Paintpot to the number seven milepost near Old Faithful.²⁹⁷

Edmund Rogers, who was appointed the new Superintendent of Yellowstone (like Toll, he was transferred from Rocky Mountain National Park), reported that the 1936 travel season posted record numbers of visitors. Visitation reached 432,570, some 36 percent higher than the 1935 figures. Rogers, who received many compliments on the condition of the road system, praised the

contractors for their handling of "traffic without very little loss of time or inconvenience to motorists."²⁹⁸ Work progressed during 1937 on 87.5 miles of road and three contracts were awarded for the construction of twelve bridges and culverts, each more than 20' in length. The CCC camps had been reduced to four over the past year and most of their road-related work was road obliteration.²⁹⁹ During the winter, all of the department heads met to discuss sign use in the park and to develop a policy to submit to the director for approval. It was agreed by all to eliminate the use of mile post signs and the officials generally agreed to a simplification of informational material on the signs. BPR Engineer C. F. Capes sent a recommendation for removal of directional signs from the junction islands and their subsequent placement at least 100' from the junctions on the right hand side of the road. He also suggested that small parking areas be constructed to "accommodate the 'sign studier'."³⁰⁰

In 1937 and 1938, park crews maintained 401 miles of roads, of which 51 miles were outside park boundaries. In 1938, a short dead-end stretch to the Bechler River ranger station in the southwest corner of the park was added to the maintenance schedule.³⁰¹ Temporary measures to improve the checking stations were taken at the North Entrance and East Entrance. In March 1937, fire destroyed the checking station inside the boundary at the North Entrance Arch. A temporary station was placed several hundred feet east of the burned station for use until a new one could be built.³⁰² At the East Entrance, plans were made to move the station to another location where it would be "off center so any new construction can be accomplished without removing the old buildings."³⁰³

The question of center striping rose again in Yellowstone National Park after four people died in two separate automobile accidents within a 48-hour period. While not proving that these accidents were caused by a lack of striping, it was inferred by an editorial in the *Livingston Enterprise*, which stated that "the absence of a stripe in the middle of the park roads is a probable cause." The vice-president of the Yellowstone Park Company, in urging Superintendent Rogers to consider restriping the roads, stated that:

The use of the center stripe has been adopted by the best highway engineers as a safety measure, and has proven and continues to prove its value. Our transportation drivers complain the Park motorists, in their attempt to view the scenery and drive at the same time, are continually

encroaching on the left side of the road, thus making travel extremely hazardous. Our own experience in driving the Company's cars verifies this report of the bus drivers.

We feel that the ordinary requirements of safety demand that the highways in this Park be immediately marked with a center stripe. Scarcely a day passes but that an accident is avoided only by the extreme care and skill of our transportation men. The contention has been maintained by the Park Service that this stripe detracts from, not only the appearance of the Park, but the motorists enjoyment of the scenery. It seems to me that it is more desirable for a tourist to leave the Park all in one piece than it is for him to see every object of interest on his tour. The use of illuminated discs on the curves, especially at night, has been of material aid in avoiding accidents and we feel that the center stripe in general use in all towns and cities and on the highways is imperative in this Park.³⁰⁴

Road construction in the park in 1938 was at its lowest ebb and employed the fewest workmen since before 1932. Most of the work that year consisted of completing projects started in 1936 and 1937. Grading was started for a section of the East Entrance Approach road and bituminous surfacing for 21 miles of the Northeast Entrance Road was begun. Some work on the Mammoth esplanade and road to Gardiner were completed, as were the two bridges over the Gibbon River.³⁰⁵

However, the projection of 1939 work was near the level for the maximum years of 1934 and 1935. Most of the 1939 work was devoted to surfacing previously graded sections. Crews finished the surfacing of 48 miles of road, began surfacing an additional 17 miles, graded 9 more, and completed the Gardiner River Bridge, including the grading and surfacing of approximately a mile of approaches. Five crushing plants and three bituminous mixing plants operated in the park that year producing over 400,000 tons of surfacing material. Several day labor projects funded by the Public Roads Administration were carried out. The day crews continued the drainage improvement program which had been in progress for several years. Its purpose was to stabilize slides and moving embankments. This expensive and tedious procedure attempted, through the installation of perforated metal drains, to release water from under the fills and thus remove the lubrication along slippage seams that caused the sliding.

Another day labor project concentrated on removing stains from the concrete bridges on the Tower Junction to Cooke City road. A Keramic solution, which had been used on the original construction, produced an unsightly color or stain on the concrete. At Superintendent Roger's request, a bush hammering technique produced a satisfactory appearance, but probably exposed the concrete to elements that would shorten its life.³⁰⁶

By far the highest profile project was completion of the Gardner River Bridge. Construction of the 940-foot bridge involved the fabrication and erection of approximately 1,000 tons of steel. Favorable weather enabled the project, begun in April, to be completed on 14 November. Workmen obliterated old road scars, some of which remained from the 1880s. The engineers felt that completion of this bridge eliminated one of the "worst traffic hazards on the Grand Loop Highway".³⁰⁷

In 1938, the park was asked by officials of the Golden Gate International Exposition to keep its roads open during the winter so that visitors could travel through on their way to the exposition in California. In response to the request, Thomas Allen, Region Two Director of the National Park Service, stated that in addition to the safety factor created by travelers unfamiliar with the hazardous conditions in Yellowstone, maintenance of the park roads in the winter would be very expensive. He explained the park would need a special congressional appropriation to cover the work.³⁰⁸ Travel figures for 1939 showed an increase over 1938. Not all of the roads were kept open for the winter; however, Congress did appropriate money for the park to keep the Gardiner to Cooke City road open for the first time. This enabled winter visitors to see the wildlife in the Lamar Valley and Cooke City citizens to leave their homes. Park officials felt the San Francisco Exposition and the New York World's Fair contributed to increased visitation.³⁰⁹

The period from 1926 to 1939 proved to be one of the most significant in the history of the road development in Yellowstone National Park. By the time the third decade ended, 155 miles of the 347-mile system had received a bituminous surface. Ninety-two of the remaining 192 miles of the system had been improved to various stages, leaving approximately 100 miles unimproved. Thirty major bridges were built. The principle focus of construction had been the Grand Loop and the entrance roads. Of the 155 miles of bituminous surfaced roads, 96 were on the Grand Loop. Only 27 miles of the Grand Loop needed to be improved, including eleven between Canyon and Norris Junction.

By the end of 1939, the old days of mudholes and dust had been eliminated. The average motorist probably did not appreciate the

transformation of the road system as he was now "accustomed to improved all-weather highways throughout the nation".³¹⁰ The National Park Service and the Bureau of Public Roads attributed their success in park road programs largely to the cooperation with the NPS Branch of Plans and Design (created through a merger of the Landscape Architecture and Civil Engineering divisions in December 1934). The satisfaction of the inter-bureau program prompted the Park Service to continue the relationship. The BPR adopted some National Park Service requirements for use on their forest highways and other Federal Aid projects, thus improving the appearance of roads outside the parks.³¹¹

In reviewing the past thirteen years of Bureau of Public Roads work in Yellowstone, BPR Engineer Capes realized that in order to maintain the public's confidence and satisfaction, considerable work still needed to be done in the park. Recognizing that many of the early Bureau projects were based on now outdated design standards and that some of the sections would not be adequate for the present and future volume of traffic, a suggested tentative six-year road improvement program, costing approximately \$6.5 million, would complete the system.³¹² A total of approximately \$9 million had been spent over the previous thirteen years.

The BPR suggested a highway classification study be completed to indicate safe speed limits on particular routes or sections of routes and to devise a classification of the routes. While the accident rate in 1939 was not significant, fatal accidents over "the past few years indicated that there was a need for an intensive safety program study." Capes believed that several safety measures--centerline striping, improved road signing, and an intensive road patrolling system initiated over the past year--helped improve safety on park roads.

In 1939, the established maximum speed limit was 45 mph, with a few 15 mph zone exceptions. Capes felt the conditions at Swan Lake Flats, Fountain Flats, near the Buffalo Ranch, and a few other road sections justified the 45 mph limit; however, the majority of the roads did not. Using computations based on sight distances of vertical and horizontal curves and braking distance in addition to three seconds' reaction time, Capes believed the majority of the roads warranted a 35 mph limit with a few exceptions--perhaps 25 mph on the Mammoth Hot Springs to Golden Gate section, most of the Norris to Madison road and the Dunraven Pass road.³¹³

Another survey requested by the BPR was a subgrade soils survey for the entire road system. While most road surface failures had been in the northern section of the park, engineers felt that it was worthwhile to investigate their causes and possible

corrections. As a whole, the system did not experience many failures due to faulty subgrades, but mostly due to slides and movements caused by "deep underground slippage seams." In addition to the soils survey, the Bureau felt that an investigation of such construction materials as sand, aggregates, and stone, would complement the National Park Service's systemwide policy proposal of "predetermining and designating quarries and pits for construction materials whereby the number of borrow pit excavations may be better controlled and limited throughout the Park."³¹⁴ Capes felt that this was particularly important in Yellowstone National Park, where engineers faced such a wide variety of geological formations.

In concluding his assessment of the Yellowstone road system, Capes advised that maintenance and improvements to the "so-called completed portions" should not be overlooked. If neglected, a major reconstruction program might be necessitated in a few years. The improvements that should be monitored were the following:

1. much of the 10-to-12 year old timber guardrail was in bad condition and unsightly
2. the bituminous surface that was completed under the trench method should be reinforced and strengthened along the edges
3. headwall hazards should be eliminated by the installation of drop inlets and gutter paving
4. attention should be given to the bituminous surfaces that showed signs of distress and were in need of seal and cover
5. monitor cross-section distortion due to subgrade or settlement movement.³¹⁵

In 1940, the Yellowstone road system accommodated a volume of vehicular traffic equal to five times the amount present when the Bureau of Public Roads took over road construction in 1926, without the restraints of the one-way system that had existed on approximately fifty percent of the Grand Loop. In 1940, road engineers continued their previous year's projects, and started only one new project late in the season. That year's accomplishments were: the completion of 34 miles of bituminous surfacing, 5 1/2 miles of grading, the construction of the 335' Lamar River Bridge, and construction of four bridges on the East Entrance Approach. Road officials projected that six major bridges remained to be built in the park and three on the

approach roads. Despite having to pay more for skilled grades of labor, road construction costs seemed to decline, probably due to improved methods and equipment and less reliance on hand labor. Only fifteen percent of the engineering force was hired from the local areas, usually jobs such as stakemen and flagmen. The remaining 85 percent were classified Civil Service personnel.³¹⁶

Capes felt that with the proposed six-year plan, all essential work would be done to complete the Yellowstone road system. The only project proposed and surveyed in 1927 that had not been planned or completed was the Bighorn Pass road off the Gallatin River Entrance road. In 1940, this road was not considered necessary. Capes expressed concern over the eighteen miles of unimproved road on the Grand Teton to Yellowstone Approach road. Calling it a "disgrace to the two National Parks which it serves," he stated it had the "lowest standard of improvement of any Federal Aid highway in that section of the State, and being a link in both U.S. Highways 89 and 287, is very deserving of improvement."³¹⁷

With the diligent maintenance program costing \$200 to \$300 per mile that Capes had been promoting, the park could avoid major rehabilitation in a few years. Capes recognized the various problems of road construction in such a diverse area. One of the major problems was frost heave damage which varied from year to year. The worst areas in the park occurred where roadbeds crossed wet or swampy areas over superimposed 3' to 4' fills. In Yellowstone, frost could go down 5' to 6' and cause the roadbed to heave.

Another concern was that asphaltic material of the older bituminous surfaces had oxidized and become brittle. Any slight underground movement seemed to result in surface cracks. Still another concern was the parkwide replacement of timber guardrail. Most of the existing guardrail had deteriorated to a condition where it settled out of alignment and no longer provided protection; furthermore, it presented an unsightly appearance.³¹⁸ The State of Wyoming recommended that the National Park Service abandon the standard log guardrails used on all park roads and replace them with the post and reflector type that Wyoming had adopted. In the end, the National Park Service began using a native stained post, 8" in diameter, with a reflector placed on each post, spaced 30' to 50' apart.³¹⁹

Maintenance crews continued the oiling program, treating more than sixty miles of roadway. The procedure varied from the use of a dust palliative treatment on unreconstructed roads to the use of a more intensive road mix. About 30 miles was sealed with a rapid-curing oil treatment, followed by application of native

pit-run sand or rhyolite.³²⁰ Maintenance issues received national attention, perhaps as a result of the rapid expansion of the National Park System, including the Natchez Trace and Blue Ridge parkways and Shenandoah's Skyline Drive, as well as the fact that more motorists were visiting national parks. During the 1940 travel season, visitation figures for the system were more than 16.7 million people; and Yellowstone, for the first time, reached more than one-half million (526,437).³²¹

The National Park Service began gathering detailed road data and equipment records in order to formulate a comprehensive road maintenance program. The engineering laboratory was used to examine road and construction materials.³²²

CHAPTER X

THE WAR YEARS UP TO MISSION 66

The standards of roads within the parks do not necessarily need to comply with the highway standards outside of the parks and moreover, the parks, of necessity, should set standards of their own.

--Frank Mattson, National Park Service Landscape Architect, 1951

Due to inclement weather, the 1941 road construction program in Yellowstone reached its lowest volume of work since the Bureau of Public Roads engineers became involved in 1926. In addition to the weather problem, the road program also began to be affected by the pre-war atmosphere and preparation at the national level. With more efforts focused on defense projects, it was reasonable to expect park road work to be curtailed. On a positive note, however, the past urgency for immediate road improvements had passed, and now engineers had time to develop more detailed studies and plan what was needed for the overall park system. An immediate example of a pre-war problem, and one that would become more serious over the next few years, was the difficulty of hiring skilled labor in the area. In 1941, for example, most jobs were filled by inexperienced young men.

The 1941 travel season witnessed the highest number of vehicles yet to enter the park and the total visitor count again exceeded a half million. Using both a Butte-electric mechanical recorder and a manual count, road engineers were able to establish information necessary to predict inadequacies in the road system, in particular, where bottlenecks might occur. They found that the southern half of the system received the most traffic and that the planned work for this section would adequately provide the needed service. The study indicated the 12-mile section from Arnica Creek to Bridge Bay would need improvement, as well as the West, East, and South entrance roads, since they carried about eighty percent of the traffic. Records showed the Grand Loop was accommodating about 4,000 vehicles per day on some sections. Feeling this was the maximum number for the existing width of the two-lane roads, the engineers recommended that consideration be given to widening and/or stabilizing the shoulders to provide space for emergency situations and parking.

The 1940 East Entrance road project, construction of parking areas near Squaw Lake, the extension of approximately 500' of

stone paved gutters, and improvement to a large cut bank near the Fishing Bridge parking area were completed during 1941. Another 1940 project completed in 1941 was the grading of 4 miles in the vicinity of Canyon Junction, and construction of a triple 3' x 9' treated timber box culvert. Work began on the West Thumb to Old Faithful section, and consisted mainly of surfacing, road obliteration, and flattening and stabilization of slopes. Plans called for the construction of the Isa Lake Bridge, but there was difficulty in securing treated timber. Surfacing progressed on the East Entrance Approach road but was not completed in 1941.

Minimal survey work was carried out, but an interesting test, begun in 1940 on the effects of hydrogen sulphide gas at the excavation pits for the bridge foundation on the Northeast Entrance road, was concluded during the summer. In 1940, a concrete cylinder was buried in the thermal area in hopes of finding the effects of the gas on concrete. In 1941, it was unearthed and put under a compression test. The cylinder showed no effects from the gas, and finally broke under a load of 5,000 pounds per square inch.

In his recommendations for 1942, Capes again stressed the necessity for substantial guardrails. He found they were generally made of local timber which had been cleared from the rights-of-way. The use of lodgepole pine was considered an economic and temporary measure since the wood is of poor quality and is short-lived. Capes felt that pine rails had served their purpose, but strongly urged conversion to a more substantial type. He further recommended a newly manufactured curved metal steel rail to replace the deteriorated sections. He felt that if the metal were painted brown, it would resemble the rustic pine log rails. He suggested that the metal rails be attached to salt-treated timber from the west coast region.

Park crews proceeded with center line striping and Capes recommended the entire system be striped. He urged double center stripes be applied, or some other type of warning in areas where visibility was limited. He particularly suggested that the Gibbon Canyon, the Old Faithful to West Thumb, and the Dunraven Pass sections receive this attention, as well as some of the entrance roads.

Capes predicted the decrease in tourism to Yellowstone due to the world situation, but he felt that this lull in the program would offer a good time for planning for the future. He could also foresee that the increased visitation in 1941 and the establishment of the United States Travel Bureau as a division of the National Park Service, would probably mean that when the country returned to a normal condition, visitation would again

take giant leaps.³²³

In December 1941, the United States declared war against Japan, Germany and Italy. Within weeks, measures were taken in Yellowstone to aid the war effort, including tire rationing within the park. Department heads requested that use of government vehicles be carefully monitored, and cooperation in all transportation be urged.³²⁴ The emergency situation resulted in many of the Public Roads Administration engineers being sent to work on the Alaska Road project. However, a few were kept back to continue work in Yellowstone.

The Isa Lake Bridge on the West Thumb to Old Faithful road was completed, but would not go into service until surfacing on this stretch was finished. The East Entrance road surfacing was completed, but the final step, the plant mix mat on the Old Faithful surfacing project, was delayed because the Public Roads Administration office in Denver gave the contractor permission to defer completion until the war was over. The Canyon project was closed for the duration.³²⁵

At the national level, limited road construction proceeded with the grading of the Crystal Cave Road in Sequoia National Park; the excavation, construction of a 535' tunnel through solid rock, and grading of the Rimrock Drive in Colorado National Monument; the Yazoo City Road at Vicksburg National Military Park; and the Virginia Highway 24 Bypass Road at Appomattox Courthouse National Historical Park. Work also continued on the Blue Ridge and Natchez Trace parkways.³²⁶ However, most major projects ground to a halt.

In fiscal year 1942, visitation across the system showed a decrease of thirty percent and Yellowstone dropped just below the half million mark. Due to rationing, the National Park Service and the concessionaires in the parks, curtailed their promotions for park visitation. Almost all construction in the parks was halted as it was in most other federal agencies. A small segment of the planning office remained in the regional offices and in the Washington office. Their priority was to respond to any emergencies, but they also spent considerable time on the "plans-on-the-shelf" program, which the National Park Service had been requested to prepare. The idea for the program was to not only provide "mature and sound plans for future programs of development," but to "take up the slack in employment that may well be anticipated at the end of the war."³²⁷

The National Park Service contributed in many ways to the war effort in 1943. In Yellowstone, the main roads were kept open for military trucking on an emergency basis. Any damage

sustained by these operations would be repaired after the emergency was over. No road contract work was underway and all of the CCC road camps had been discontinued. Even though the CCC did not play a major role in the road construction program, it remained involved with landscape improvements. The Mammoth and Cascade Creek CCC camps were transferred to the War Relocation Authority and the buildings were sent to the Heart Mountain Relocation Project near Cody.³²⁸

Visitation to Yellowstone fell to its lowest number in many years. A loss of 67 percent over the 1942 travel season was recorded. Most visitors were nearby residents or those involved in cross-country, war-related travel. None of the hotels, lodges or cafeterias were open in the park.³²⁹

The only large road project associated with the National Park Service in 1943 was a study for the protection of the landscape and prevention of unplanned development on government lands through which the 310 miles of the Alaska Highway were being constructed.³³⁰

The number of park visitors dropped again in 1944, but increased somewhat in 1945. During both of those years, park maintenance crews were made up of old men and high school boys. Again, no new work was initiated during these years, but due to Lake Yellowstone reaching its record-setting height in July 1944 and the resulting wind and wave action, emergency work had to be done on the roads at Steamboat Point, Mary Bay, and West Thumb. Another problem was the frost boils and heaves on the Gallatin road, which required reshaping and processing. The concrete rails on the Chittenden Bridge needed some filling with cement grout. However, the rails were in such deteriorated condition that complete replacement was projected for two or three years hence. Other maintenance activities involved deck replacement on the Gardner River Bridge two miles north of Mammoth Hot Springs and the partial construction of a log bridge at Soda Butte Creek.³³¹

In addition to the Chittenden Bridge concrete rail problem, the log railings, which were set in the curbs of the concrete bridges on the Tower Falls to Cooke City road, were badly deteriorated and in need of replacement. After his 1944 visit, NPS Acting Chief Engineer A. W. Burney suggested to Chief Landscape Architect Vint that the rails be replaced with the National Park Service standard type steel railing then being used on most of the newly built concrete bridges in Yellowstone. Vint felt that the problem bridges had not been designed to support the new steel railings and replacement with log railings would be easier and more economical. Thus he recommended replacement in like

kind.³³²

As predicted, visitation rose immediately after the war concluded, with the West Entrance being the most popular gateway. The remaining order of popular entries was East, South, North, then Northeast. Maintenance of the Red Lodge to Cooke City road, which fed the Northeast Entrance, was a problem throughout the war years. One year, the Public Roads Administration received money for its upkeep, but not for snow removal; the next year, the states of Wyoming and Montana refused any assistance, and the citizens of Red Lodge, Montana raised money to rent a snow plow to at least open the road for travel. In 1946, the states of Wyoming and Montana again refused any assistance for snow removal and maintenance of the road. After much controversy and pressure from Red Lodge, Billings, other nearby towns and from the Montana Congressional delegation, the National Park Service resumed responsibility for snow removal and maintenance. The park moved in three camps along the road.³³³

Prior to the war years, safety was an important issue and studies were requested for the system. After the war, the agency hired a safety engineer whose sole job was to "effect prompt improvement of any condition of hazard which his studies or those of others may reveal." But, the most pressing problem was staffing. Many of the functions in the parks in the prewar period had been accomplished by different emergency agencies, such as the CCC. With the demise of these agencies, along with the beginning of the 40-hour, rather than 48-hour work week for federal employees, (a decrease of one-sixth in man-hours), the work force suffered.³³⁴

"Never have the inadequacies of development of the National Park System been so highlighted as during the travel season of 1946 and 1947, which have brought such tremendous increases in numbers of visitors," wrote Newton Drury, then Director of the National Park Service. In Yellowstone, the numbers increased from 348,880 in fiscal year 1946 to 827,032 in fiscal 1947. During the war years, the roads actually did not suffer much deterioration, but the surge of visitors afterwards caused much destruction to the road system, particularly since most of these visitors came in their own vehicles. The Public Roads Administration had in readiness plans and surveys for as estimated \$4,151,000 worth of park road work, in addition to \$21,007,600 for future parkway projects. However, in fiscal year 1947, only a \$48,619 contract for the bituminous surfacing of five miles of road was awarded in the entire system. In summer 1947 (fiscal year 1948), a contract was awarded for seven miles of bituminous surfacing between Old Faithful and West Thumb.³³⁵

By the end of June 1948, the park's visitation was nearing one million and it registered well over a quarter of a million vehicles. The Isa Lake to Old Faithful stretch finally received the bituminous surfacing that had been programmed for completion prior to the war. The other prewar project completed during 1948 was the grading, base surfacing, and construction of a steel and concrete bridge over the Snake River on the Moran to South Entrance Road. No other new projects were initiated during 1948. Regular maintenance such as filling pot holes, reprocessing and sealing, and center line striping continued on most of the system. A hot spot that developed on the Norris to Canyon road was solved with the placement of a heavy concrete slab. Much log guardrail was replaced, particularly on the Beryl Springs, Madison Junction, Fountain Paint Pots, Mammoth to Tower Falls, and Mammoth to Norris sections. A new deck was placed on the first bridge out from Gardiner toward Mammoth Hot Springs, and log cribbing and guard rails were replaced on the eastern approach to the Yellowstone River Bridge near Tower Falls.³³⁶

Yellowstone visitation exceeded the one million mark at the end of the 1948 travel season with the popularity of the entrance stations remaining in the prewar order, West, East, South, North, and Northeast. The acceleration in the numbers of visitors prompted the park to enforce an improved safety program. This included improved accident investigation reports to be used in conjunction with the Wyoming Planning Board traffic volume study, more center line striping, widening of shoulders, building additional smaller parking areas, and increasing the number of patrol cars.

The overall road condition of the system was considered fair in July 1949, with the exception of the South Approach Road and the Canyon to Norris road. Considerable patching had to be done systemwide, and over 600' of log guardrail had to be replaced on the East Entrance Road and 320' on the Bechler Road near Cave Falls. An entire deck was replaced on one of the bridges of the Firehole Loop Road. Road crews now occupied only three road camps in the park and one on the Red Lodge to Cooke City road.

Problems again arose on the Gallatin road. A 400' section broke into "a regular quagmire, black sticky silt being pushed up through the light bituminous mat and cars and trucks were getting stuck". This occurred about a mile south of the Bacon Rind road camp. Steam vents broke out on the road in three locations in the park--in front of the Norris Museum, near Nymph Lake, and near the Mud Volcano. Two new construction projects were started at the end of 1948 and continued into the 1949 season. One was a 38-mile chip sealing project on the Mammoth Hot Springs to Firehole Canyon road, the other a grading and base surfacing

project in the Canyon area.³³⁷

The National Park Service was able to secure war surplus equipment for road and trail construction with funds from the National Military Establishment and the War Assets Administration. Stated value of the equipment was \$322,000. The same donation of equipment occurred after the end of World War I. However, the 1940s equipment was not in as good a condition and replacement parts were hard to find. Nevertheless, construction began again across the system with ten new road projects started, including the two in Yellowstone and others in Colonial National Historic Park, and Great Smokey Mountains, Shenandoah, Rocky Mountain, Zion, Bryce Canyon, Yosemite, Sequoia, and Kings Canyon national parks.

Surveys indicated that cost per mile for maintenance on the park roads for the near future would be approximately \$571 per mile, some 75 percent of the national average. The reality of the financial situation was that the national budget could only provide approximately \$320 per mile, leaving the park roads in less than satisfactory condition. Thus, the National Park Service engineering division devised a five-year program to help alleviate the maintenance problem. With over 5,215 miles of park roads in the system, the program called for \$3.5 million in 1950 with increases annually to \$3.9 million in 1954. These funds helped eliminate post-World War II special maintenance projects. The goal was to reach a point at which a preventive maintenance program could be established on an annual basis. An amortization program was established to assist in having adequate equipment.³³⁸

In March of 1950, Superintendent Rogers submitted a list of needed Yellowstone road system improvements amounting to \$41,870, knowing full well not all would be accomplished:

Madison to Old Faithful--restore raveled edges, restore eroded shoulders--.5 miles

Old Faithful to West Thumb--restore raveled edges, 3 miles; replace 1,000' guardrail with guide posts.

West Thumb to Lake Junction--sand seal, 10.4 miles; reprocess 2.5 miles; replace guardrail with guide posts, 1,500'.

Lake Junction to Canyon Junction--replace guardrail with guide posts, 2,000'; treat with linseed oil, 5,000' guardrail

Tower Falls to Mammoth Hot Springs--base course repairs

East Entrance to Lake Junction--repair stone barriers,
parking at Mary's Bay

Moran to South Entrance--center stripe

Northeast Approach road--chip seal 1.5 miles; replace rail
and curb logs, Rock Creek and Wyoming Creek bridges

Canyon to Norris--repair two Gibbon River bridges

Canyon area--replace rock retaining walls at 3 places on
Mount Washburn Road

Mammoth Hot Springs to Gardiner--center stripe--4.8 miles³³⁹

Yellowstone's maintenance crews started the 1950 season doing routine patching over most of the system and the South and Northeast Approach roads. Guardrails were replaced on the Lewis River, Sheep Creek, Fox Creek, and Index Creek bridges, and the Teepee Creek Bridge on the Gallatin road was reconstructed. Some shoulder improvement was done between Mammoth Hot Springs and Madison Junction. Maintenance crews also applied pentachlorophenol to guide posts, guardrails, and bridge timbers as a preservative. Most new work involved grading and base surfacing on the northern half of the South Approach road. Under a Minor Road Construction project, the South Approach Road was widened. A construction camp was set up near Lizard Creek.³⁴⁰

In 1951, Frank Mattson, Yellowstone's landscape architect, reported on road standards and maintenance in the park. Mattson felt that the initial purpose of improving road standards, providing wider and safer roads and offering roadside parking to permit the visitors to observe the wonders of the park, had not been accomplished. The recent improvement of treating the shoulder with bituminous surfacing had only increased the width of the traffic lanes, thus creating a three-lane-plus traffic surface, inviting faster speeds and hazardous passing conditions. Mattson reiterated the earlier National Park Service philosophy, "The standards of roads within the parks do not necessarily need to comply with highway standards outside of the parks, and moreover, the parks, of necessity, should set standards of their own."³⁴¹

A 1952 inspection of the park's primary roads showed the system in generally good condition, with the exception of the Gallatin Road. As stated earlier, an unstable subgrade, the less than desirable base, and the heavy volume of truck traffic continued to plague the engineers on this section. Approximately 75 percent of the 21.3-mile road had been patched or showed

distress. It was felt that at least 12.5 miles would need complete reconstruction. The good condition assessment of the remaining system was attributed to the improved maintenance practices of ditch cleaning and other drainage methods.

One of the major maintenance jobs had been, and would be for the next few years, replacement of thousands of feet of log guardrail. The 1952 inspections called for several thousand feet of new log railing to be replaced as funds permitted. The other major maintenance job was shoulder widening.³⁴²

For the next few years, no new major construction projects got underway, and routine maintenance tried to address the ever increasing problems.³⁴³ However, the question of the maintenance of the park approach roads attracted the attention of the Congress. In "Report on Negotiations for States to Take Over the Maintenance of Roads Outside the Boundaries of the National Parks and Monuments as Required by the Conference Report on the Interior Department Appropriation Bill, 1955," three of the Yellowstone roads were at issue--the Northeast Approach Road, the 59.86 miles from Red Lodge to Cooke City Montana; the 7-mile South Approach Road; and the Gallatin Road, U.S. No. 191, with 22 miles inside the boundary of the park. The report suggested:

South Approach Road--This road is so short and so far removed from State maintenance forces that the State of Wyoming would be unwilling to assume the responsibility. It appears that the only practical solution would be to extend the boundaries of the park to include this road in the National Park System. Gallatin Road--This road is in an isolated section of the park and serves only minor park interests as compared to the usage it receives throughout the year by commercial traffic. . . . The Governor was requested by Assistant Secretary Lewis on March 5, 1954, to consider transfer of this road to the State, and at the Governor's suggestion, a meeting of Service and State Highway personal held on June 2, 1954 for a general discussion of the matter. Subsequently, the State took action to accomplish a portion of the reconstruction and is currently working on a two-mile section within the park in conjunction with contiguous construction just outside of the park. The Service will follow up on the various aspects of this general operation relative to additional reconstruction and determination of the width of right-of-way acceptable in transferring responsibility to the State. Northeast Approach Road--This road begins in Montana, then passes into Wyoming, and back into Montana before reaching the park boundary. The National Park Service has not been successful in getting the States to take over either section. Field

studies in recognition of the stalemated situation suggest that the Service should continue to maintain this road and eventually propose appropriate action to give the Service jurisdiction over the roadway proper, plus jurisdiction over a strip of land abutting the road of sufficient width to permit the control of undesirable development or use. If the above objective cannot be attained, the Service can, as has been done in the past: (1) continue its efforts to have the State of Montana take over the easterly section (approximately 15 miles) to the Montana-Wyoming line; (2) continue with Service maintenance of the Wyoming section (approximately 31 miles) until such time as a connecting road from the south would be included in the Wyoming State System, making State maintenance of the Wyoming section of the approach road more practicable and feasible; and (3) recognize that the westerly section (approximately 10 miles) in Montana is so isolated from State operations that maintenance by the State is impractical and should remain a Service responsibility.³⁴⁴

CHAPTER XI

MISSION 66

In all phases of the work the landscape architect and the highway engineer shall exercise imagination, ingenuity, and restraint to conserve park values.

--Conrad Wirth, Director, National Park Service,
1958

In the early 1950s, with visitors to the National Park system increasing at record rates, funding and staffing inadequate, and the physical plants and road systems in deteriorated condition or otherwise inadequate, a dismal picture was being painted for the parks and monuments. In a 1953 *Harper's Magazine* article, "Let's Close the National Parks," author Bernard DeVoto presented the state of the parks situation. DeVoto wrote:

Congress did not provide money to rehabilitate the parks at the end of the war, it has not provided money to meet the enormously increased demand. So much of the priceless heritage which the Service must safeguard for the United States is beginning to go to hell. ...The crisis is now in sight. Homeopathic measures will no longer suffice; thirty cents here and a dollar-seventy-five there will no longer keep the national park system in operation. I estimate that an appropriation of two hundred and fifty million dollars, backed by another one to provide the enlarged staff of experts required to expend it properly in no more than five years, would restore the parks to what they were in 1940 . . . No such sums will be appropriated. Therefore only one course seems possible. The national park system must be temporarily reduced to a size for which Congress is willing to pay. Let us, as a beginning, close Yellowstone, Yosemite, Rocky Mountain, and Grand Canyon National Parks--close and seal them, assign the Army to patrol them, and so hold them secure till they can be reopened. . . . held in trust for a more enlightened future...[perhaps this would] bring this nationally disgraceful situation to the really serious attention of the Congress which is responsible for it."³⁴⁵

Perhaps the national focus on the parks dilemma forced action,

because it was not long before the endorsement of President Dwight D. Eisenhower, his Cabinet, and the Congress backed the National Park Service's new ten-year plan, "Mission 66," a proposal to "develop and staff these priceless possessions of the American people as to permit their wisest possible use; maximum enjoyment for those who use them; and maximum protection of the scenic, scientific, wilderness and historic resources that give them distinction." The new program was projected to be completed in time to celebrate the 50th anniversary of the creation of the National Park Service. The main focus of this program of "enjoyment-without-impairment" was the construction of roads, trails, camp and picnic grounds, public use and administration buildings and utilities to meet the needs of the expected 80 million visitors in 1966. An estimated \$786 million was needed to complete the plan. Congress, with the support of western senators and representatives, appropriated \$448,866,300 for 1956, \$68 million for 1957, \$76,004,000 for 1958, and \$79,962,000 for 1959. However, road funds were given under the authority of the Federal Aid Highway Act, which in 1956 amounted to \$16 million.³⁴⁶

In Yellowstone, the Mission 66 program intended to address three areas in order for the park to "yield the benefits of which it is capable: an adequate road and trail system giving access to important and significant features of the park; adequate facilities for visitor comfort, welfare, and subsistence; and effective presentation, interpretation, and protection of the resources of Yellowstone by a management staff."³⁴⁷

The park projected visitation of over two million by 1966 and officials knew the road system was the "major key to the most effective use." The original configuration of the Grand Loop and the entrance roads still fulfilled visitor needs, but it was felt the system needed to be modernized to accommodate present and future traffic volume. The Mission 66 plan did not call for any additional roads, but rather suggested that some existing roads be relocated away from important features. The road standards of 20' of traffic lane, with an additional 3' of flanking-improved shoulder, were used. In addition to addressing the road system, attention was given to providing sufficient parking and pullout areas to aid visitors in their enjoyment of the resources and beauty of the park safely. The plan also called for replacement of fourteen old bridges considered too narrow for present day traffic. The estimate for the ten-year road and trail improvement program was \$36.5 million. The total estimate for all improvements for the Mission 66 program in Yellowstone was \$70 million, which included the private investment of \$15 million by the concessioner for lodges, cabins, and other facilities. Yellowstone administrators estimated that, in order to provide proper maintenance, management, protection and service to

visitors, operational costs would rise from \$1,471,000 to \$2,226,000 by 1966.

Park officials felt that the first new visitors would encounter some inconvenience due to facilities and road construction, but the overall goal of providing them with a "meaningful experience in observing, enjoying, and understanding Yellowstone would be worth the 10-year effort."³⁴⁸

In 1956, the reconstituted Bureau of Public Roads and the National Park Service began formulating the projects for the program's first year, 1957. The tentative plans called for three projects--base and top surfacing of the Lake Junction to Canyon Junction road and construction of adjacent parking areas (11.4 miles); the final paving of the Norris Junction to Canyon Junction road; and top surfacing of 3.5 miles of the east section of the road.³⁴⁹

The two agencies agreed to specific design and construction items:

1. A minimum width of 26 feet will be used which includes 22 feet of pavement and 2-foot shoulders. Additional width up to 28 feet, primarily on fill sections, to be obtained where possible through utilization of waste material resulting from slope flattening and other operations.
2. Native grass shoulders to be provided by addition of fines to shoulder material, nutrients, seeding and watering, and a bituminous mulch. This would not be equivalent to a stabilized grass shoulder, but is the best that can be provided on the present roadbed.
3. Plant mix surfacing to be included on all parking areas in lieu of bituminous surface treatment previously proposed.
4. Due to the type of material available for the plant mix, the Bureau of Public Roads recommended and all concurred in elimination of seal coat and chips. The reason for this is that material requires excessively long period to cure and a seal coat would merely retard this process. In addition, the Bureau is of the opinion that a seal coat is not necessary on the dense graded plant mix surfacing to be used on this job.
5. A special design has been prepared for the Mud Geyser area using a concrete slab with proper drainage provided for the escape of gases and corrosive liquids.

The concrete slab to be surfaced with a standard plant mix pavement.

6. Horizontal alignment near station 445 to be eased to relieve sharp turn from the South. Vertical curve between 416-426 to be lowered to provide better sight distance.

7. Since existing fill slopes have stabilized naturally over the years, all bituminous berms will be eliminated except for approximately 375 feet in two locations.

8. All standard AASHO regulatory signs to be furnished and installed by the contractor. Road striping to be done by the National Park Service with funds provided as a supplemental item in the estimates.

9. At parking areas painted delineator strips to be used rather than minimal aggregate guide markers.

10. Bituminous gutters to be used but only in reasonably dry locations where subsurface moisture conditions will not cause early disintegration.

11. Minimum 8-inch diameter guide posts to be substituted wherever possible for guardrail. However, some guardrail replacement will still be required in certain hazardous locations.³⁵⁰

In addition, it was decided that 12" diameter log curbs would be used in all of the ten new parking areas instead of the 18" logs or stone curbing, which was prohibitively costly and difficult to obtain. All logs used for curbing, guardrails, and guide posts were to be given a soak treatment of "penta" after fabrication.

Roadside slopes which were stabilized and had revegetated naturally would not be disturbed. Those that were disturbed would be seeded with native grasses, watered, and mulched. All surfacing, aggregate material and top dressing was to be obtained from the Trout Creek pit, and all concrete aggregate from outside the park.³⁵¹

Toward the end of 1956, the tentative ten-year road program was set. However, several emergency situations and logistical problems caused by building construction in particular areas shifted priorities a bit.³⁵² Due to the necessary passage of many heavily loaded vehicles supplying construction activities, the replacement of older, weak bridges moved to the top of the list. While these bridges appeared adequate for visitor needs,

bottlenecks caused by hauling supplies, safety factors, and increased building costs due to construction delays demanded their immediate replacement. Of particular concern were the condition of the Lewis River Bridge and the Yellowstone River Bridge near Tower Junction. Very high water in spring 1956 caused heavy runoff, especially on the East Entrance Road. Extensive damage was caused by slides and erosion, requiring new and more substantial drainage structures.³⁵³

In November, 1958, Conrad Wirth, a landscape architect by training and the then Director of the National Park Service, wrote a preamble for the "Handbook of Standards for National Park and Parkway Roads" in which he tried to guide the direction in which this extensive Mission 66 program would take road improvements and reconstruction in the system.

This *Handbook* is intended to be used as a guide by those who are responsible for the locating, designing and building of park and parkway roads. The purpose of roads in units of the national park system is to give the public reasonable and leisurely access to scenic and other features. Such roads shall be located, designed and constructed with this in mind. Thus they become principal facilities for presenting and interpreting the inspirational values of a park, monument or parkway. In the location, design and construction stages, the alignment, grade and cross section of all park and parkway roads shall be fitted to the terrain as closely as possible to preserve the landscape. Pavement, shoulder widths and curvature should be adequate for the leisurely traveler and turnouts and parking overlooks shall be provided at frequent intervals. In all phases of the work the landscape architect and the highway engineer shall exercise imagination, ingenuity, and restraint to conserve park values.³⁵⁴

However, the 1958 standards did allow "tremendous flexibility of application" and in many areas of the system, the weakness of the standards resulted in the unnecessary ruination of distinctive park landscapes by new roads, especially the Grand Canyon South Rim Road and the Tioga Road reconstruction in Yosemite.

By 1966, some fourteen major bridges and several major culverts had been constructed in Yellowstone.³⁵⁵ For the most part, these new spans blended with the environment, despite the fact that their design moved away from the obvious rustic design of the pre-World War II era.

While the widths of the roads increased and more modern and less

rustic bridges were built in the park, it would be the period just after the Mission 66 when part of the Yellowstone road system would take on a "less than park roads-like feeling". The construction of the modern, "anywhere USA" Old Faithful Interchange in 1969 was a definite deviation from the nearly ninety-year old philosophy of roads "blending with the environment." The motives for building a bypass to remove the traffic congestion away from the natural features were quite sound, but the execution was a landscape design failure. During the late 1960s, bypasses for the park's other congested intersections were discussed and planned for Lake, Fishing Bridge, Grant Village, and West Thumb. In addition to the Old Faithful Interchange, four new bridges were built in the 1970s.³⁵⁶

As the park prepared to move into the twenty-first century and meet the needs of not only the American visiting public but ever-increasing foreign visitation, a twenty-year road reconstruction program was begun in 1988 by the Federal Highway Administration. With improved technology, copious park planning, and sensitive park management, improved park roads should provide twenty-first century visitors not only comfort and safety, but also a subtle experience. In the travelers' quest to visit the different natural wonders and major areas, it is the Grand Loop and the Entrance Roads that provide the continuity of feeling that one is in a "special place".

ENDNOTES

1. William F. Reynolds, "Report on the Exploration of the Yellowstone and Missouri Rivers in 1859-60," Senate Executive Documents 77, 40th Congress (1868), 11.
2. Kenneth J. Baldwin, *Enchanted Enclosure: The Army Engineers and Yellowstone National Park, A Documentary History* (Washington: Historical Division, Office of the Chief of Engineers, United States Army, 1976), 1.
3. Edwin J. Stanley, *Rambles in Wonderland, or, A Trip Through The Great Yellowstone National Park* (Nashville, TN: Southern Methodist Publishing House, 1885), 90-91.
4. Nathaniel P. Langford, "Report of the Superintendent of the Yellowstone National Park for the year 1872," in *Annual Report of the Secretary of The Interior for 1872* (Washington, D.C.: Government Printing Office, 1873), 2-3.
5. Nathaniel P. "National Park" Langford was a member of the famous 1870 Washburn Expedition which has been credited with suggesting that the wonders in this region be set aside as a national park. The nineteen-man group spent forty days exploring in the park and are responsible for naming more than twenty natural features.
6. Langford, 2-3, 7. The proposed circuit would go from the Lower Geyser Basin eastward to Lake Yellowstone then northward at its outlet along the Yellowstone River to the Yellowstone Falls, past Mount Washburn to Tower Falls, then on to the Hot Springs on Gardner River and in as near a direct line as possible to the northern boundary of the park. From the Mammoth Hot Spring area the circuit should go east, then "a direct line across the park to the Lower Geyser Basin." He also planned a road from the lower approach to the Geyser Basin to a junction below the outlet at Lower Yellowstone. Langford proposed an entrance road from Bottler's Ranch to Mammoth Hot Spring on the north and from Henrys Lake and the Lower Geyser on the southwest.
7. Bob Randolph O'Brien, "The Yellowstone National Park Road System: Past, Present, and Future" (Ph.D. Thesis, University of Washington, 1964).
8. Henry J. Norton, *Wonderland Illustrated: or Horseback Rides Through the Yellowstone National Park* (Virginia City, MT: no publisher, 1873).

9. Mrs. George F. Cowan, *Reminiscence of Pioneer Life*; O'Brien, "Yellowstone Road System."
10. Edwin Stanley, *Rambles in Wonderland, or a Trip Through the Yellowstone National Park* (Nashville, TN: Publishing House of the Methodist Episcopal Church, South, 1989), 50.
11. Lorraine and Orrin Bonney, *Battle Drums and Geysers: The Life and Journals of Lt. Gustavus Doane, Soldier and Explorer of the Yellowstone and Snake River Regions* (Chicago: The Swallow Press, 1970), 464.
12. Langford, 23.
13. Langford to Columbus Delano, Secretary of the Interior, 20 May 1872. Yellowstone Library, M62 R.1.
14. Albert L. Rose, "The Highway from the Railroad to the Automobile," in *Highways In Our National Life: A Symposium* (New York: Arno Press, 1972).
15. Louis Cramton, *Early History of Yellowstone National Park And Its Relation to National Park Policies* (Washington D.C.: Government Printing Office, 1932), 37.
16. Langford to Delano, 7 November 1873. Yellowstone Library, M62 R.1.
17. Cramton, 39.
18. William A. Jones, *Report Upon the Reconnaissance of Northwestern Wyoming Including Yellowstone National Park Made In the Summer of 1873* (Washington D.C.: Government Printing Office, 1875), 58.
19. F. V. Hayden to Delano, 14 November 1873. Yellowstone National Park Library, M62 R.1.
20. Langford to Delano, 6 February 1874. Yellowstone Library, M62 R.1.
21. William Belknap, Secretary of War, to Delano, 4 March 1874. Yellowstone Library, M62 R.1.
22. William Ludlow, *Report of a Reconnaissance From Carroll, Montana, on the Upper Missouri to the Yellowstone National Park*,

and Return, Made in Summer of 1875 (Washington D.C.: Government Printing Office, 1875), 36-37.

23. Cramton, 41.

24. O'Brien, 52-54.

25. Philetus W. Norris, *Report to the Secretary of the Interior, Upon the Yellowstone National Park for the Year 1877* (Washington, D.C.: Government Printing Office, 1877), 840.

26. Aubrey L. Haines, *The Yellowstone Story, A History of Our First National Park*, Vol. I (Yellowstone Library and Museums Association in Cooperation with Colorado Associated University Press, 1977), 217.

27. Norris, 1877, 837.

28. *Ibid.*, 843-44.

29. *Ibid.*, 845. See Haines, *The Yellowstone Story*, Vol. I, Ch. 8, "Warfare in Wonderland."

30. *Ibid.*, 841.

31. Norris, *Report Upon the Yellowstone National Park for the Year 1878, to the Secretary of the Interior* (Washington D.C.: Government Printing Office, 1878), 979.

32. Norris to Carl W. Schurz, Secretary of the Interior, 26 June 1878.

33. Norris, 1878, 979-80.

34. M.M. Quaife, *Yellowstone Kelly: The Memoirs of Luther S. Kelly* (New Haven, CT: Yale University Press, 1926), 24-25.

35. *Ibid.*, 484, 980-81.

36. *Ibid.*, 983.

37. *Ibid.*, 983-84.

38. *Ibid.*, 984.

39. *Ibid.*, 986. The east fork of the Yellowstone is now called the Lamar River.
40. Norris, *Report Upon the Yellowstone National Park for The Year 1879* (Washington, D.C.: Government Printing Office, 1880), 3.
41. *Ibid.*, 3-4. The three existing routes were "first a very rough and difficult one, over two dangerous--now bridged--near the forks, and past a cascade and two cataracts upon the east branch to the forks of the Yellowstone --distance, 20 miles, second, over my road of last year up the dry pass between the hot springs terraces down Sepulchre Mountain to the geysers--distance, 60 miles, and third, by the old road, over the mountain spurs and rugged canons, 6 miles to the Yellowstone River, and through its second canon and Bozeman's Pass over the Gallatin Range to Fort Ellis and Bozeman--distance, 80 miles." 4.
42. *Ibid.*, 5.
43. *Ibid.*, 6.
44. Norris found evidence of Truman Evarts, Ferdinand Hayden, and others "amid the dense snow covered, storm-twisted, knotted, and gnarled thickets of the continental divide." He also found an odometer left by Captain Jones and Professor Comstock during their 1873 expedition. Norris, 1879, 6-7.
45. *Ibid.*, 17, 22.
46. *Ibid.*, 7, 17.
47. *Ibid.*, 7.
48. *Ibid.*, 10. Currently some of the other secondary roads are older routes but Bunsen Peak was planned as an interpretive or secondary road.
49. Norris, *Annual Report of the Superintendent of the Yellowstone National Park for the Year 1880* (Washington, D.C.: Government Printing Office, 1881), 34.
50. *Ibid.*, 34.
51. *Ibid.*, 34.

52. The new west entrance route left the Madison River at Riverside, proceeded over the Madison Plateau, joining the Firehole River near Nez Perce Creek.

53. Norris, 1880, 5, 9-10.

54. *Ibid.*, 23, 38. Norris said that the Natural Bridge "was once the brink of a cataract nearly one hundred feet over a ledge of peculiarly hard, variegated trachyte up here to the vertical access the stream. Directly across this ledge, countless layers of erosion have formed first a shallow trough like channel; then, or simultaneously with this channel, a vertical orifice, several feet long by one foot wide, between the strata, some two feet from the brink . . . The chasm is fully spanned by the bridge, which, by measurements, I found to be twenty-nine feet long, and including the above mentioned vertical orifice, ten feet height above the top of the arch, and forty-one feet to the bedrock of the chasm, which, at this point is a rapidly deepening cascade."

55. *Ibid.*, 13.

56. *Ibid.*, 14-15.

57. John Ponsford to Secretary of the Interior, 6 September 1880.

58. Norris, 1880, 25.

59. *Ibid.*, 4, 14-15.

60. Norris, *Fifth Annual Report of the Superintendent of the Yellowstone National Park, September 1881* (Washington D.C.: Government Printing Office, 1881).

61. *Ibid.*, 18-19.

62. *Ibid.*, 22. See Appendix A for Synopsis of Roads, Bridle-Paths, and Trails In the Yellowstone National Park.

63. *Ibid.*, 69-70. One bridge at the head of the Upper Falls of the east fork at the Gardner River; one bridge over the Main Blacktail Creek; one bridge over Elk Creek near the Dry Canyon; three bridges in the valley at the east fork of the Firehole; two bridges on Alum Creek; two bridges upon Sage Creek; two bridges upon Hot Spring Creek (all on new route or the Shoshone bridle path to Lake Yellowstone). Two footbridges crossed the Firehole Rivers near the forks and two crossed the Firehole in the Upper

Geyser Basin.

64. C.J. Baronett to S. J. Kirkwood, Secretary of the Interior, 6 October 1881.

65. Norris, 1881, 18.

66. *Ibid.*, 73.

67. Hiram Martin Chittenden, *The Yellowstone National Park: Historical and Descriptive* (Cincinnati, OH: Robert Clark Company, 1895), 131-132.

68. P. H. Conger, *Annual Report of the Superintendent of the Yellowstone National Park to the Secretary of the Interior by P.H. Conger, Superintendent, for the Year 1882* (Washington, D.C.: Government Printing Office 1882), 4.

69. *Ibid.*, 6.

70. *Ibid.*, 5, 9.

71. Henry M. Teller, Secretary of the Interior, to Conger, 14 July 1883.

72. Kingman did not file any reports with the Chief of Engineers, but a later Army Corps of Engineer officer, Capt. Clinton B. Sears, did include Kingman's notes on road improvements and construction in his report to the Chief of Engineers. See "Annual Report of Captain Clinton B. Sears, Corps of Engineers, for the Fiscal Year Ending June 30, 1887," in *Report of the Secretary of War Being Part of the Messages and Documents Communicated to the Two Houses of Congress in Four Volumes* (Washington D.C.: Government Printing Office, 1887).

73. *Ibid.*, 2-3.

74. *Ibid.*, 6. The road crews ranged from 12 to 20 men under the supervision of a foreman, and each crew was provided with a cook. The pay scale varied from \$40/month for a common laborer to \$50-\$75/month for a foreman. Board was furnished. Daily ration for one man: fresh meat or 1 1/2 lbs. bacon or ham; 3/4 lb. flour; 1 lb. lard; 1/10 lb. potatoes or 2 lbs. onions or canned vegetables; 1 lb. coffee, roasted, or 2 ozs. tea; 2/3 oz. beans, or 3 ozs. oatmeal or rice; 3 ozs. canned fruits or 1/2 lb. dried fruit; 1/4 lb. butter or 3 ozs. syrup; 1 gill pickles or cheese;

3 ozs. condensed milk; 1/5 can baking powder; 7/100 lb. salt; 01/100 lb. soap; 4/100 lb. candles; 2/100 lb. vinegar; 1/100 gallon pepper and matches. Portions were based upon the average cost of 80 cents a day for rations.

75. *Ibid.*, 10-11.

76. *Ibid.*, 11.

77. *Ibid.*, 27.

78. *Ibid.*, 11-12. "This route, though heavily timbered and covered in many places with rock and loose boulders, offered no serious obstacles to the construction of a road until the head of the cañon was reached. Here for about a thousand feet, the rock walls approached each other and were nearly vertical, and the little stream in the canyon had a fall of 30 or 40 feet. Fortunately, however, the rock was of a columnar structure and there existed a natural bench, partly concealed by the talus, at about the right height, and which, by a little blasting and filling, will make an admirable road bed."

79. *Ibid.*, 10-11.

80. Road work projects for 1884-1885:

1. Repair and improvement of existing road from Mammoth Hot Springs to boundary of park toward the terminus of the park branch of the Northern Pacific Railroad about 5 miles . . . \$5,000.
2. Complete improvements of road from the Mammoth Hot Spring to Fire Hole Basin, 36 miles. . . \$25,000.
3. Improvement of road from Fire Hole to Canon and Falls of Yellowstone, 28 miles . . . \$2,500.
4. Improvement of road from Fire Hole Basin to upper Geyser, 10 miles . . . \$8,000.
5. Improvements of branch above route to outlet of Yellowstone Lake . . . \$7,000.
6. For repairs and improvements of the road from Mammoth Hot Springs to Yancey's, 18 miles . . . \$1,500.
7. For constructing a new road from Yellowstone Falls via the east trail over Mt. Washburn to Yancey's, 20 miles . . . \$25,000.

81. Kingman Report, 1883, 23-24.

82. Rufus Hatch to Teller, 1 December 1883.

83. *Ibid.*

84. D. W. Wear, Superintendent, to Teller, 3 December 1885.

85. Kingman to Teller, 25 March 1885.

86. Lee H. Whittlesey, in *Yellowstone Place Names*, states that Dan Kingman, Oscar Swanson, or Ed Lamartine (the road bosses in charge of the project) probably named the canyon when they were building the first stagecoach road through Glen Creek in 1883-1884. The canyon could also have been named by park tour operator G. C. Henderson, who reported on the construction project in 1884:

To avoid the terrible hill on the only possible route from Mammoth Hot Springs to the upper districts of the park, the government has begun a road along the west fork of the Gardner River (Glen Creek)
. . . . When complete, this new route--the Golden Gate--will present an easy round and one that will be accessible fully two weeks earlier than that over the mountain [present day Snow Pass] up which the road now leads. (*Livingston Enterprise*, 6 August 1884.) Lee H. Whittlesey, *Yellowstone Place Names*, (Helena: Montana Historical Society Press, 1988).

87. Kingman report, 1885.

88. *Ibid.*

89. *Ibid.*

90. *Ibid.*

91. *Ibid.*

92. *Ibid.*

93. *Ibid.*

94. *Ibid.* Kingman's proposed regulations:

1. That all wagons used for the transportation of freight within the limits of the National Park shall be equipped with tires not less than 3 inches wide, and that such wagons be allowed to carry a net load of less than 3,000 pounds.
2. That for the net load of 3,000 pounds and less than 4,000

pounds, wagons shall be provided with four inch tires.
3. That for all loads of 4,000 pounds net and upwards, they shall use 5 inch tires.
4. That it be made the duty of the Superintendent and his assistants to strictly enforce the rules.

95. H.S. Muldrow, Acting Secretary of Interior, to Superintendent, Yellowstone National Park, 25 May 1886.

96. Charles Gibson to Capt. Moses Harris, 23 August 1886.

97. Kingman report, 1889.

98. *Report of the Secretary of War Being Part of the Messages and Documents Communicated to the Two Houses of Congress in Four Volumes* (Washington, D.C.: Government Printing Office, 1887), Appendix AAA, "Annual Report of Captain Clinton B. Sears, Corps of Engineers, for the Fiscal Year Ending June 30, 1887," 3138-39.

99. ^o Sears, 1887 report, 3138-39.

100. *Ibid.*, 3140.

101. Harris, "Annual Report of the Superintendent of Yellowstone National Park for the Year 1888," 7, 12.

102. "Annual Report, 1889," 2863. Bridges in the park by 1889:

1. Three spans of 33 feet over Gardner River. No truss.
2. Three spans of 32 feet over Gardner River King post.
3. One span of 28 feet, a coulee. No truss.
4. Trestle of 224 feet. Kingman's Pass. [Golden Gate]
5. One span of 14 feet over West Gardner. No truss.
6. One span of 12 feet over a slough. No truss.
7. Two spans of 40 feet and 20 feet over Gardner River. King and queen truss.
8. One span of 32 feet over Obsidian Creek. King post.
9. One span of 16 feet over Obsidian Creek. No truss.
10. One span of 32 feet over Obsidian Creek. King post.
11. One span of 34 feet over Gibbon. King post.
12. One span of 20 feet over slough at Norris. No truss.
13. Two spans of 40 feet over Gibbon. Queen post.
14. Trestle 75 feet long over Gibbon River. Queen post.
15. One span of 38 feet over Firehole River. No truss.
16. Trestle of 66 feet over Firehole River.
17. Two spans of 36 feet over Firehole River. No truss.
18. One span of 24 feet over Gibbon River. No truss.
19. One span of 20 feet over Gibbon River. No truss.

20. Trestle 115 feet long near Yellowstone Falls.
21. One span of 40 feet over Cascade Creek. King and queen post.

Number of culverts built..... 100
Linear feet of parapets and railings.....
1,000

103. *Ibid.*, 2862-63.

104. Capt. F. A. Boutelle, *Report of the Superintendent of Yellowstone National Park* (Washington, D.C.: Government Printing Office, 1890), 8-9.

105. Capt. George S. Anderson, *Report of the Superintendent of the Yellowstone National Park to the Secretary of the Interior*, 1891 (Washington, D.C.: Government Printing Office, 1891), 6.

106. *Idem*, *Report of the Superintendent of the Yellowstone National Park to the Secretary of the Interior*, 1892 (Washington, D.C.: Government Printing Office, 1892), 3, 5.

107. Maj. W. A. Jones, Corps of Engineers, "7th Indorsement U.S. Engineer Office, Saint Paul, Minnesota, November 14, 1892."

108. Anderson, 1892, 11.

109. *Idem*, *Annual Report of the Superintendent of Yellowstone National Park to the Secretary of the Interior*, 1893 (Washington, D.C.: Government Printing Office, 1893), 8.

110. *Ibid.*; *Idem*, *Report of the Acting Superintendent of the Yellowstone National Park to the Secretary of the Interior*, 1894 (Washington, D.C.: Government Printing Office, 1894), 8.

111. *Idem*, *Report of the Acting Superintendent of the Yellowstone National Park to the Secretary of the Interior*, 1895 (Washington, D.C.: Government Printing Office, 1895), 8, 11.

112. *Idem*, *Report of the Officer in Charge of Construction and Maintenance of Roads, Etc., in the Yellowstone National Park to the Secretary of War*, 1896 (Washington, D.C.: Government Printing Office, 1896), 5.

113. *Idem*, 1896, 8, 11.

114. Col. S.B.M. Young, 3rd Cavalry, *Report of the Acting Superintendent of the Yellowstone National Park to the Secretary of the Interior, 1897* (Washington D.C.: Government Printing Office, 1897), 4. Bridges built in 1897: (1) Trout Creek, (2) Firehole River at Riverside Geyser, (3) over ravine near West Thumb, (4) Gibbon River in Virginia Meadows, (5) Green Creek, (6) footbridge over Firehole River near Biscuit Basin, and (7) over east branch of Gardiner River above Undine Falls.

115. Young to Quartermaster General, 13 August 1897.

116. Young, "Report of Acting Superintendent, 1897," 24. There is little historical documentation relating to this commission.

117. *Ibid.*, 22, 34.

118. Capt. James B. Erwin, *Report of the Acting Superintendent of the Yellowstone National Park to the Secretary of the Interior, 1898* (Washington, D.C.: Government Printing Office, 1898).

119. Hiram M. Chittenden, "Roads in Yellowstone National Park,"-- Senate, 226, 50th Congress, 1st Session. Acting Secretary of War Transmitting in Response to Resolution of the Senate of March 12, 1900, Letter from Chief of Engineers, U.S.A., Together with the Copies of Originals for All Reports Related to the Present Condition and Appropriate Plans for the Development of the System of Roads in the Yellowstone National Park. For an account of Chittenden's proposed road program, see the appendices.

120. Chittenden, *Annual Reports Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices FFF, III, and JJJ of the Annual Report of the Chief of Engineers for 1901* (Washington, D.C.: Government Printing Office, 1901), 3778-80.

Additions to the plant were two and 1 single-seated survey for inspections uses, 1 boom derrick with complete fittings, 1 hoisting engine, 2 dump carts, 2 hovel carts, 1 pile-driving outfit, 6 wheel scrapers, and 63 tents.

121. *Ibid.*, 3784, 3787-88.

122. Chittenden to Brig. Gen. G. L. Gillespie, Chief of Engineers, U.S. Army, 7 December 1901, 1-2, 10.

123. Idem, *Annual Reports Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices FFF, III, and JJJ or the Annual Report of the Chief of Engineers for 1901* (Washington, D.C.: Government Printing Office, 1901), 73.

124. Idem, *The Government Road System of the Yellowstone National Park, U.S. Department of Agriculture Public Road Inquiries-- Bulletin No. 21. Proceedings of the International Good Roads Congress held at Buffalo, New York, September 16-21, 1901* (Washington, D.C.: Government Printing Office, 1901), 73.

125. Ibid.

126. Ibid.

127. Idem, *Annual Report Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices FFF, and III, of the Annual Report of the Chief of Engineers for 1902* (Washington, D.C.: Government Printing Office, 1902) 3037-38.

Approximate location of the six wooden tanks:

1. one from the Fort Yellowstone water supply
2. one from the overflow from the hot springs under Jupiter Terrace
3. one about 1 1/2 miles up the hill, from a small spring near the road
4. one a half of a mile farther, one from another small roadside spring
5. one from a large spring 3/4 of a mile farther on, but about 500' from the road and considerably below it
6. one from Glenn Creek above Golden Gate

128. Ibid., 3038.

129. Idem, *Annual Reports Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices GGG and KKK of the Annual Report of the Chief of Engineers for 1903*, (Washington, D.C.: Government Printing Office, 1903) 2888-89. The Engineers' Office is adjacent to the Mammoth Hot Springs Hotel and across the esplanade from the Albright Visitor Center.

130. "Technical Report Upon the Improvement of Yellowstone National Park, 1904," 50. This document does not list an author, however, it is presumed to have been written by Captain Chittenden.

131. *Ibid.*, 50-53.

132. Chittenden, *Annual Reports Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden Captain, Corps of Engineers Being Appendices FFF and KKK of the Chief of Engineers for 1904* (Washington, D.C.: Government Printing Office, 1904) 4171; *Annual Reports . . . (1903)*, 2889.

133. *Ibid.*

134. "Technical Report . . . 1904," 58.

135. After considerable controversy the bridge was replaced in 1962.

136. Chittenden, *Annual Reports Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park and Construction of Military Roads from Fort Washakie to Mouth of Buffalo Fork of Snake River, Wyoming, and Erection of Monument to Sergeant Charles Floyd in the Charge of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices FFF and KKK, and JJJ of the Annual Report of the Chief of Engineers for 1903* (Washington, D.C.: Government Printing Office, 1903) 2893;

Annual Reports . . . (1904), 4174.

Other bridges built with material from American Bridge Company:

Yellowstone River Bridge near Yancey's
Gardner River Bridge near Mammoth Hot Springs
Gardner River Bridge near 7th Milepost south of Mammoth Hot
Springs
Firehole River Bridge 1/2 mile above Excelsior Geyser
Gibbon River Bridge near 6th Milepost south of Norris
Cascade Creek Bridge near Grand Canyon of the
Yellowstone River

137. *Ibid.*, (1903), 289; (1904), 4171.

138. *Idem*, *Annual Report Upon the Construction, Repairs, and Maintenance of Roads and Bridges in the Yellowstone National Park in the Charge Of Hiram A. Chittenden, Captain, Corps of Engineers Being Appendices GGG and KKK of the Chief of Engineers for 1905* (Washington, D.C.: Government Printing Office, 1905) 2809-10. For a summary of bridges built in 1905 and 1906, see the appendices.

139. *Idem*, "Annual Report of the Chief of Engineers for 1905," 2816.

140. *Ibid.*, 2817-21.

141. *Ibid.*, 2810-21.

142. *Ibid.*, 2821.

143. Ernest D. Peek, 1st Lieutenant, U.S. Army Corps of Engineers, *Annual Report of the Chief of Engineers for 1906* (Washington, D.C.: Government Printing Office, 1906) 2256, 2258.

Appropriations for

1900.....	\$ 55,000
1901.....	113,000
1902.....	250,000
1903.....	250,000
1904.....	133,000
1905.....	55,000

144. *Ibid.*, 2257.

145. Idem, *Annual Report of the Chief of Engineers for 1907* (Washington, D.C.: Government Printing Office, 1907), 2463.

146. *Ibid.*, 2821.

147. *Ibid.*, 2466-67.

148. *Ibid.*, 2468.

149. Idem, *Annual Report of The Chief of Engineers for 1908* (Washington, D.C.: Government Printing Office, 1908), 2544-45.

150. *Ibid.*.

151. *Ibid.*, 2549.

152. *Ibid.*.

153. Wildurr Willing, 1st Lieutenant, and C. W. Kutz, Major, U.S. Army Corps of Engineers, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park, and Report Upon the Road Into Mount Rainier National Park , Appendices GGG and HHH* (Washington D.C.: Government Printing Office, 1909) 2510-11.

154. *Ibid.*, 2513; H. C. Benson, Major, Fifth Cavalry, Acting Superintendent Yellowstone National Park to H. W. Child, President, Yellowstone Park Transportation Company, 18 April 1910.

155. J. M. Dickinson, Secretary of War, to Secretary of the Interior, 26 April 1909.

156. F. J. Haynes, President of Monida and Yellowstone Stage Company to R. L. Lomax, General Passenger Agent, Union Pacific Railroad, 14 April 1909.

157. "Report of Inspection of Bridges in the Yellowstone National Park, made September 24, 25, and 26, 1909," with recommendations by request of Captain Wildurr Willing, Corps of Engineers, U.S.A.

158. Willing and Kutz, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park, and Report Upon the Road Into Mount Rainier National Park* (Washington, D.C.: Government Printing Office, 1910), 2736.

159. Benson to Secretary of Interior R. A. Ballinger, 18 April 1910; Benson to Child, 18 April 1910. Major Benson received a telegram from the Superintendent of Yosemite National Park requesting drawings and specifications of the road water tanks.

160. Child to Benson, 20 April 1910.

161. Benson to Ballinger, 18 April 1910.

162. F. T. Crowe, Superintendent of Construction, United States Reclamation Service to Ballinger, 11 June 1910; Benson to Crowe, 18 June 1910.

163. Capt. C. H. Knight, Maj. J. B. Cavanaugh and Maj. Jay J. Morrow, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park, and Report Upon the Road Into Mount Rainier National Park, Appendices HHH and III* (Washington, D.C.: Government Printing Office, 1912) 3031-32.

164. Acting Superintendent to James and Will Moore, 17 October 1910; W. H. Davis, Chairman Board of Commissioners, Gallatin County, Montana, to Lt. Col. L. M. Brett, Acting Superintendent Yellowstone National Park, 14 October 1911.

165. J. F. Haynes, *Transportation in the Yellowstone National Park*, Proceedings of the National Park Conference held at the Yellowstone National Park September 11 and 12, 1911 (Washington, D.C.: Government Printing Office, 1912).

166. *New Roads in Yellowstone National Park*, Acting Secretary of War transmitting information in response to Senate Resolution of April 2, 1912, relative to the cost of construction of new roads in the Yellowstone National Park, 62nd Congress, 24th Session Senate Document No. 871 (Washington, D.C.: Government Printing Office, 1912), 3, 14-16.

167. Brett to Secretary of the Interior Walter L. Fisher, 14 May 1912 and 20 May 1912.

In addition to the problems caused by the natural conditions, the Yellowstone Transportation Company wagons hauling coal "shook the road at the dangerous and narrow part that a section of it fell into the river, leaving a roadway of only about 3 feet in width for a distance of 12 feet." Brett to Child, 2 May 1912.

168. Brett to Fisher, 22 June 1912.

169. Capt. C. H. Knight, Maj. J. B. Cavanaugh, and Maj. Jerry J. Morrow, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park; Report Upon the Road Into Mount Rainier National Park; and Report Upon Crater Lake National Park*, Appendices EEE and FFF (Washington, D.C.: Government Printing Office, 1913) 3268-70.

170. E. H. Schumacher, County Clerk of the Board of Commissioners, Gallatin County, Montana, to Maj. E. S. Wright, 12 March 1913; District Engineers' Office, Yellowstone National Park, to Chief of Engineers, U. S. Army, 16 February 1914.

171. Charles Waterman, Gallatin County Commissioner, to Honorable John K. Evans, M.C.; Schumacher to Brett, 6 February 1914.

172. District Engineer Officer, Yellowstone National Park, to Chief of Engineers, U.S. Army, 16 February 1914.

173. Special Orders No. 181, War Department, 5 June 5 1914.

174. Maj. Amos A. Fries and Maj. Jay J. Morrow, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park; and Report Upon Crater Lake National Park*, Appendices EEE and FFF (Washington: Government Printing Office, 1914), 3393-95.

175. Acting Superintendent, Yellowstone National Park, to Secretary of the Interior, 5 August 1914; Assistant Secretary of the Interior to Acting Superintendent, 6 August 1914 (telegram).

176. Fries, "Yellowstone Park Road Work," 11 August 1914.

177. Ibid.. See Appendices for the "Rules and Regulations for the Work of the Engineering Department in Yellowstone National Park," 4 May 1915.

178. Fries to Secretary of the Interior, 10 May 1915; Stephen T. Mather, Assistant Secretary of the Interior, to Brett, 26 May 1915.

179. Fries, *Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park* (Washington, D.C.: Government Printing Office, 1915), 3753-65.

180. Major Amos A. Fries, *Report Upon the Construction, Repair and Maintenance of Roads and Bridges in the Yellowstone National*

Park, (see above) and *Report Upon Crater Lake National Park*
(Washington, D.C.: Government Printing Office, 1916), 3626-27.

181. Henry Breckenridge, Acting Secretary of War to Chairman of
Committee on Appropriations, House of Representatives, 15 January
1916.

182. Fries, *Report Upon . . . Yellowstone National Park* (1916),
3631.

183. *Ibid.*, 3633.

184. Fries and Col. George Zimm, *Report Upon the Construction,
Repair, and Maintenance of Roads and Bridges in the Yellowstone
National Park for 1917.* (Washington, D.C.: Government Printing
Office, 1917) 3633.

185. Horace Albright, Acting Director, National Park Service to
Fries, 7 May 1917.

186. Fries to Albright, 14 July 1917.

187. Chester Lindsley, Supervisor, Yellowstone National Park, to
Capt. John Schulz, 9 October 1917.

188. Albright to Franklin K. Lane, Secretary of the Interior, 17
October 1917.

189. Maj. G.E. Verrill and Col. George Zimm, *Report Upon the
Construction, Repair, and Maintenance of Roads and Bridges in the
Yellowstone National Park; Report Upon the Road Into Mount
Rainier National Park; and Report Upon Crater Lake National Park
Appendices EEE and FFF*, (Washington, D.C.: Government Printing
Office, 1918), 1977-80.

190. *Report of the Director of the National Park Service to the
Secretary of the Interior for the Fiscal Year Ended June 30, 1918*
(Washington, D.C.: Government Printing Office, 1918) 39-40.

191. *Ibid.*, 40.

192. *Ibid.*, 273-74.

193. Mather, *Report of the Director of the National Park Service
to the Secretary of the Interior for the Fiscal Year Ended June*

30, 1919 (Washington D.C.: Government Printing Office, 1919), 25-26.

194. *Ibid.*, 46-47.

195. *Ibid.*.

196. *Ibid.*, 31-57.

197. *Ibid.*, 160, 165.

198. *Ibid.*, 167.

199. *Idem*, *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1920 and the Travel Season 1920* (Washington D.C.: Government Printing Office, 1920), 90, 92.

200. *Ibid.*, 102, 106.

201. *Ibid.*, 104.

202. *Ibid.*, 104, 209.

203. *Ibid.*, 234.

204. *Ibid.*, 213.

205. *Idem*, *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1921 and the Travel Season 1921* (Washington, D.C.: Government Printing Office, 1921), 163.

206. *Ibid.*, 167.

207. *Ibid.*, 169.

208. *Ibid.*, 171.

209. *Ibid.*, 24, 49-50.

210. *Ibid.*, 56, 58-59.

211. *Ibid.*, 63, 65, 187.

212. Idem, *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal year Ended June 30, 1922, and of Travel Season 1922* (Washington D.C.: Government Printing Office, 1922), 37, 102, 104-105.

213. B. L. Vipond, "Park Service Outlines Plans," *Western Highway Builder IV* (December 1922), 11.

214. *Ibid.*

215. C. C. Cotrell, "National Park Roads Vitally Needed," in *Ibid.*

216. Lawrence Phipps, U.S. Senate, "Roads in National Parks," speech in the Senate of the United States, Friday, 5 January 1923 (Washington D.C.: Government Printing Office, 1923), 2-3.

217. *Ibid.*, 5.

218. Mather, *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1923 and the Travel Season, 1923* (Washington D.C.: Government Printing Office, 1923) 37-38; *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1924 and the Travel Season, 1924*, (Washington D.C.: Government Printing Office, 1924) 11; *Stockton Record*, 22 December 1923. The article describes proposals for the California parks.

219. Mather, *Report of the Director* (1923), 10-11.

220. *Ibid.*, 48-49.

221. *Ibid.*, 114-16.

222. Arno B. Cammerer, Acting Director, National Park Service, to Albright, 26 December 1923.

223. Published hearings before the House of Representatives Committee on the Public Lands regarding H. R. 3682, 68th Congress, 1st Session, 7 February 1924, 3, 18-20, 26-27. The text of the hearings contains good information on other national parks--Yosemite, Crater Lake, Mount Rainier, Glacier, Mount McKinley, Grand Canyon, Mesa Verde, Hawaii, General Grant, Lassen Volcanic, Sequoia, Lafayette, Rocky Mountain, Wind Cave, Platt,

and Zion.

224. Mather, *Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30th, 1924, and the Travel Season, 1924* (Washington, D.C.: Government Printing Office, 1924), 12.

225. *Ibid.*, 34, 96.

226. Albright, "Report on Roadside Cleanup," 8 October 1924; *Report of the Director Of the National Park Service* (1924) 96.

227. John D. Rockefeller, Jr. to Albright, 15 August 1924.

228. Albright to Rockefeller, 2 September 1924.

229. Albright, "Report on Conditions of the Roadsides Between the Superintendent's office at Mammoth Hot Springs and Norris Junction, September 1924." There are good photographs in Rockefeller Archives of before and after views of the cleanup program. Many details of the cleanup can be found in the correspondence and reports regarding the project. These are located in the Rockefeller Archives in Tarrytown, New York.

230. Rockefeller to Albright, 9 October 1924.

231. Albright, "Report on Roadside Clean-up," October 8, 1924.

232. Rockefeller to Albright, 16 October 1924.

233. Albright to Rockefeller, 4 November 1924.

234. *Ibid.*

235. Albright to Mather, 17 June 1924.

236. *Ibid.*

237. *Ibid.*

238. Albright to Mather, 11 November 24.

Recapitulation

<u>Approach</u>	<u>Miles</u>	<u>Forest</u> <u>Fund</u>	<u>Federal</u> <u>Aid</u>	<u>State & Local</u> <u>Compensation</u>	<u>Total</u>
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YELLOWSTONE ROADS AND BRIDGES
HAER No. WY-24
(page 154)

North	5.54	\$70,000.00	\$25,465.67	\$22,807.48
\$118,273.15				
Northwest	12.7	60,000.00	29,928.96	26,498.20
				116,427.16
West	11.6		601,388.17	49,331.61
				109,719.78
South	45.883	191,510.67	69,495.00	37,999.53
299,005.20				
East	8.803	81,225.00	129,710.48	92,604.71
303,540.19				
<hr/>				
	84.526	\$420,735.67	\$855,988.28	\$229,241.53
\$946,965.48				

239. R. W. Burney, Assistant Engineer, Yellowstone National Park to Albright, 6 December 1925.

240. Leroy Hill, Acting Superintendent, Yellowstone National Park to Congressman Scott Leavitt, 7 December 1925.

In Doris Whithorn's "Yankee Jim's National Park Toll Road and the Yellowstone Trail," April 1989, she writes "In 1924 construction was started on 277 miles of grade, this time on the east side of the river--across the gorge from Yankee Jim's rough trail. When the contractor, L. T. Lawler of Butte announced the January completion of the grading and rock work started on August 18th with a crew of 60 men, the comment ran: 'The construction of a road on the east side of the river to eliminate the hills in Yankee Jim Canyon has been the desire of Park County people for a number of years.' During 1925 all of the 10 miles from Carbella to Corwin were graded and immediately there were plans to hard surface the entire section. It was August 1926 when the paving project was done, and by mid-September of that year, traffic was routed over the beautiful new highway. Altogether for the 10-mile stretch there had been an outlay of \$92,000-\$60,000 worth of grading and \$32,000 for hard surfacing." (45-46).

241. John Ise, *Our National Park Policy: A Critical History* (Baltimore, MD: John Hopkins Press, 1961), 327.

242. Albright to Mather, "National Park Road Construction," 15 April 1925.

243. Stephen Mather, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for 1925* (Washington, D.C.: Government Printing Office, 1925), 134.

244. Robert Shankland, *Steve Mather of the National Parks* (New York: Alfred A. Knopf, 1954), 157-59; Kathryn Steen, *Historic American Engineering Record, Historical Report, Going-to-the-Sun Road, Glacier National Park, Montana*, HAER No. MT-67, draft report (1990), 16.

245. Vernon L. Hammons, "A Brief Organizational History of the Office of Design and Construction National Park Service 1917-1962," unpublished document, n.d..

246. Mather, "Engineering Applied to National Parks," *Proceedings of the American Society of Civil Engineers*, v. 54, December 1928, 2675. Mather delivered this paper at the Joint Meeting of the City Planning and Highway Division, New York, New York, 19 January 1928. A copy of the NPS/BPR agreement can be found in the appendices.

247. Idem, *Annual Report* (1925), 135.

248. *Ibid.*, 135-136.

249. *Ibid.*, 78-79.

250. *Ibid.*

251. Albright to Junius W. Johnson, District Engineer, Bureau of Public Roads, Denver, CO, 11 March 1926, File Box: Roads General Correspondence, 1919-1926, Folder, Roads Correspondence May-December, 1926, Yellowstone National Park Archives.

252. Arno B. Cammerer to Thomas MacDonald, 11 September 1926, File Box: Roads, General Correspondence 1919-1926, File, Roads Correspondence May-December 1926, Yellowstone National Park Archives.

253. Albright to Mather, 18 June 1926, File Box: Roads, General Correspondence 1919-1926, Folder Roads Correspondence May-December 1926, Yellowstone National Park Archives.

254. "Tentative suggestions for improving road employee's housing facilities at Mammoth and in the Park," File Box: Roads, General Correspondence 1919-1926, Folder, Roads Correspondence May-December, 1926. Yellowstone National Park Archives.

255. *Ibid.*.

256. Mather, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for 1926* (Washington, D.C.: Government Printing Office, 1926), 54-56.

257. "Report on the Roadside Cleanup, Spring and Fall 1926," "The Report on Roadside Cleanup, Yellowstone National Park, 1927" RG III, 2E, Box 83, Folder 774, Rockefeller Archives, Tarrytown, New York.

258. Albright, *Annual Report of Superintendent of Yellowstone National Park for 1926* (Washington, D.C.: Government Printing Office, 1926).

259. Albright to Rockefeller, 26 May 1927, RG III, 2E, Box 83 Folder 774, Rockefeller Archives, Tarrytown, New York.

260. Superintendent's Monthly Report, October 1926, 3, Yellowstone National Park Library.

261. F. A. Kittredge and M. F. Daum, an unpublished report of survey of Yellowstone Park roads July 10-13, 1927, File Box, Roads--Correspondence--1927-1929, File Roads, 1927, Yellowstone National Park Archives.

262. Albright to Mather, 12 July 1927. File Box: Roads, Correspondence-1927-29, File, Roads, 1927, Yellowstone National Park Archives.

263. Albright to Mather 19 August 1927, File Box, Roads General Correspondence 1927-1929, File Roads 1927; Idem, "Annual Report of the Superintendent of Yellowstone National Park for 1927," 2, 7. Yellowstone National Park Archives.

264. Albright, "Report on Roadside Clean Up Yellowstone National Park 1927." RG III 2E, Box 83, File 774, Rockefeller Archives, Tarrytown, New York.

265. "Annual Report of the Superintendent of Yellowstone National Park for 1928," 6; Monthly Report for June 1928, File 143, Box Bureau of Public Roads, Roads Monthly Reports 1928, Yellowstone National Park Archives.

266. *Ibid.*, 6-7.

267. Albright to T. C. Vint, Chief Landscape Architect, National Park Service, 27 September 1928.

268. Monthly Report for August 1928, File 143; Daum to C. Lord, 26 July 1928. File Box: Bureau of Public Roads, Roads Monthly Reports 1928, Yellowstone National Park Archives.

269. Daum to C.F. Capes, Highway Engineer, Bureau of Public Roads, 25 July 1928. File Box: Bureau of Public of Public Roads Monthly Reports 1928, Yellowstone National Park Archives.

270. Frank A. Nickols, "Picturesque Highways Built in National Parks to Give Access a Natural Beauty of Woodlands," article in Horace Albright Papers, Albuquerque, New Mexico.

271. Albright, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for 1929* (Washington, D.C.: Government Printing Office, 1929), 132-33.

272. Albright, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for 1929* (Washington D.C.: Government Printing Office, 1929), 134-35; "Annual Report of the Superintendent of Yellowstone National Park for 1929," 17-18.

273. Albright, "Unusual Difficulties Encountered in Developing System of Scenic Highways in National Parks", in Horace Albright Papers, Roads/Trails file, Albuquerque, New Mexico.

274. Idem, "Scenic Reserves", 4; *The Saturday Evening Post*, 14 September 1929, 4546.

275. Albright, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for 1931* (Washington D.C.: Government Printing Office, 1931), 121.

276. *Ibid.*, 129-31.

277. *Ibid.*, 32-33.

278. *Ibid.*, 2-3.

279. Monthly Narrative Report, 31 August 1931, Yellowstone National Park District No. 3, Yellowstone National Park Archives.

280. Albright, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended 1931* (Washington, D.C.: Government Printing Office, 1931), 77.

281. *Ibid.*, 76.

282. Idem, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1932* (Washington, D.C.: Government Printing Office, 1932), 1.

283. Frank Kittredge, "Preserving a Valuable Heritage", *Civil Engineering II* (September 1932), 553, 536-37.

284. "Broken-back" curves are curves separated by short sections of roadway constructed on a tangent. The short, intervening straight sections make these curves more difficult to negotiate than those which flow naturally into one another.

285. L. I. Hewes, "America's Park Highways," *Civil Engineering II*, September 1932, 537-40.

286. "Annual Report of the Superintendent of Yellowstone National Park for 1933," Yellowstone National Park Library.

287. Roger Toll, Superintendent, Yellowstone National Park to Capes, 4 September 1933.

288. "Annual Report of the Superintendent of Yellowstone National Park for 1934," Yellowstone National Park Library.

289. *Ibid.*, 20-21; "Report of Sanford Hill, Landscape Architect, Emergency Conservation Works, July 1934," Yellowstone National Park Collection, Box 10, National Archives and Records Administration, Denver, Colorado.

290. Walter D. Popham, Temporary Landscape Architect, "Emergency Conservation Work. Report to the Chief Architect Through the Superintendent of Yellowstone National Park for the month of September, 1934," Yellowstone Collection, Box 10. National Archives and Records Center, Denver, Colorado.

291. Toll to Vint, 30 November 1934; Landscape Architecture and Engineers Reports for 1934-1960, Yellowstone National Park Archives.

292. "Of the 328 miles of maintained road within the park boundaries, 210 are on the Grand Loop, 52 miles are subsidiary or side trip roads, and the remaining 66 miles are service roads in the Government and concession utility areas." "Annual Report of the Superintendent of Yellowstone National Park for 1935," 16.

293. The Northeast Entrance Station is considered a classic example of the entrance or checking stations of the National Park Service. It was designated a National Historic Landmark in 1986.

294. Toll to Capes, 18 September 1935, File Box: Roads and Bridges 1919-1936, Yellowstone National Park Archives; "Annual Report of the Superintendent of Yellowstone National Park for 1935," 17-18.

295. Untitled document found in File Box: Road Specs, Bridge Specs 1919-1936. 1956, Folder: Grand Loop Highway 1-D-2 Report, July 6, 1936 to August 13, 1936, Bid Contract and Bond Report, Yellowstone National Park Archives. See Appendices for a copy of the specifications.

296. Toll to Arno Cammerer, Director, National Park Service, 12 February 1936, File Box: Road Construction, File: 332.1 F.Y. 1934, Yellowstone National Park Archives.

297. "Annual Report of the Superintendent of Yellowstone National Park for 1936," 5, 24, 26.

298. Edmund Rogers, Superintendent, Yellowstone National Park, September 1936 monthly report, Yellowstone National Park Archives.

299. "Annual Report of the Superintendent of Yellowstone National Park for 1937," 40-41.

300. Howard Gregg, Assistant Landscape Architect, "Monthly Report to the Chief Architect, for November 20 to December 20, 1937, for Yellowstone National Park," Box File: Landscape Architects and Engineers Reports, 1934-1960, Yellowstone National Park Archives.

301. "Annual Report of the Superintendent of Yellowstone National Park for 1938," 26-27.

302. Gregg, *op cit*.

303. Sanford Hill and James K. Somerville, "Report on Yellowstone National Park, October 1938," File Box: Landscape Architects-Engineers, Yellowstone National Park Archives.

304. Rogers to Director, National Park Service, 15 August 1938, File Box: 630 Roads, General, Part 1, 1936-1939, Yellowstone National Park Archives.

305. Capes, "Progress Report Season of 1939 on Public Roads Administration Activities on the Yellowstone National Park Highway System Yellowstone Park Wyoming, Federal Works Agency Public Roads Administration District No. 3," 18 December 1939, Technical Information Center, Denver Service Center, National Park Service, Denver, Colorado.

306. *Ibid.*.

307. *Ibid.*

308. Thomas Allen, Region Two Director, National Park Service, to C. M. Vandeburg, Director, Publicity and Promotion Department, Golden Gate International Exposition, 20 May, 1938, File Box: Roads Construction, General Correspondence, 1936-1939, 1945-1953, Yellowstone National Park Archives.

309. "Annual Report of Yellowstone National Park for 1939."

310. Capes, "Progress Report (1939)."

311. Thomas Carpenter, Stanley Abbot, and Edward Zimmer, "Report of the Committee on Roads and Parkways," Branch of Plans and Design Conference, Washington D. C., February 23 to 28, 1939, in File Box: Landscape Architects/Engineers, Folder, 1939 reports, Yellowstone National Park Archives. The Bureau of Public Roads adopted the following NPS techniques:

1. design for flattening and rounding of earth cut slopes
2. transition cut slopes in relation to flat gutter slopes and paved gutter ("Flattening the lower part of steep cut slopes gives stability and enables plant growth to become established. This will reduce maintenance in the gutter sections to a considerable extent. Taking the slope as a whole, curvature at the bottom together with curvature in the reverse direction at the top, results in an ogee. As a form, curvature at the bottom of the slope improves the perspective appearance through the resultant feeling of stability expressed. Actual stability of the slope is created in the lower portion of 1:1 and 1-1/4:1 slopes, with the introduction of a slope 1-1/2:1 and flatter at the bottom. It is the kind of slope that nature makes at the bottom of steep slopes through erosion, in reaching angle of repose. Slopes of this kind appear to be more of a natural part

of the landscape than the straight geometric or plane form, and serve to further the appearance of the road fitting the natural terrain It is recognized that this type of sloping may not apply in terrain that is predominantly rock."

3. flat gutters avoid the sharp angles and permit cars to pull off the traveled lanes" a better appearance is gained and safety added to the road." A rough textured finish for the gutters and top of shoulders to enable a driver to know when he has left the travel lane.

312. Capes, "Progress Report (1939)."

"Based on meager information we (Bureau of Public Roads) have thus far obtained, it is found that the average traffic density on the Grand Loop Route is 250 to 300 vehicles per hour, and on the Entrance Roads, about 150 per hour. The character of traffic is primarily passenger vehicle traffic, as the volume of truck traffic seldom amounts to more than 5% of the total. Based on the average annual increase for the past five years, it is reasonable to forecast that in 1945 the traffic density on the Grand Loop will be 400 vehicles per hour and the Entrance Roads, 200 per hour."

313. *Ibid.*

314. *Ibid.*

315. *Ibid.*

316. Capes, "Progress Report Season of 1940 on Public Roads Administration Activities on the Yellowstone National Park Highway System Yellowstone Park Wyoming, February 28, 1941," File Box: No. 40, Progress Reports, Public Roads Administration--1940, Yellowstone National Park, National Archives and Records Center, Denver, Colorado.

317. *Ibid.*

318. Idem, "General Maintenance Inspection Report on Yellowstone National Park Highway System, Wyoming, May 15, 1940," File Box: Roads General, Yellowstone National Park, National Archives and Records Center, Denver, Colorado.

319. Sanford Hill, "Narrative Report on Yellowstone National Park, May 1940," File Box 10: Monthly Narrative Reports,

Landscape Architects, Yellowstone National Park, National Archives and Records Administration, Denver, Colorado.

320. "Annual Report of the Superintendent of the Yellowstone National Park for 1940."

321. "Annual Report of the Superintendent of Yellowstone National Park for 1941."

322. *Report of the Secretary of the Interior for the Fiscal Year Ending June 30, 1940* (Washington, D.C.: Government Printing Office, 1940), 194-95.

323. Capes, "Progress Report Season of 1941 on Public Roads Administration Activities on the Yellowstone National Park Highway System, Yellowstone Park Wyoming," February 2, 1942.

324. "Annual Report of the Superintendent of Yellowstone National Park for 1942;" Sanford Hill, "Report of the Associated Landscape Architect for February 25 to March 25, 1942," File Box: Monthly Narrative Reports for 1942, Yellowstone National Park, National Archives and Records Administration, Denver, Colorado.

325. Sanford Hill, "Monthly Report of the Associate Landscape Architect for March 26 to April 25, 1942;" "Monthly Report of the Associate Landscape Architect for July, 1942;" "Monthly Report of the Associate Landscape Architect for August, 1942," File Box: Monthly Narrative Reports for 1942, Yellowstone National Park, National Archives and Administration, Denver, Colorado.

326. *Annual Report of the Director of the National Park Service to the Secretary of the Interior for Fiscal year Ended June 1941* (Washington D.C.: Government Printing Office, 1941) 276, 279, 282, 299.

327. *Annual Report of the Director of the National Park Service to the Secretary of the Interior for Fiscal Year Ended June 1942* (Washington, D.C.: Government Printing Office, 1942), 161, 163, 168-69.

328. "Annual Report of the Superintendent of Yellowstone National Park for 1943," 16; *Report of the Director of The National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 1943* (Washington, D.C.: Government Printing Office, 1943).

329. "Annual Report of the Superintendent of Yellowstone National Park for 1943," 1.

330. *Annual Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended 1943* (Washington, D.C.: Government Printing Office, 1943), 215.
331. "Annual Report of the Superintendent of Yellowstone National Park for 1944," 7, 9; "Annual Report of the Superintendent of Yellowstone National Park for 1945," 7.
332. Memorandum to NPS Region Two Director from NPS Acting Chief Engineer A. W. Burney, 2 April 1945, Record Group 79, Entry 7, File Box: 1741, National Archives and Records Administration, Washington D. C.
333. "Annual Report of the Superintendent of Yellowstone National Park for 1946," 1-2, 11.
334. *Annual Report of the Director of the National Park Service to the Secretary of the Interior for Fiscal year Ended June 30, 1946* (Washington, D.C.: Government Printing Office, 1946), 330.
335. "Annual Report of the Superintendent of Yellowstone National Park for 1947;" Newton Drury, *Annual Report of the Director of the National Park Service to the Secretary of the Interior for Fiscal Year Ended June 30, 1947* (Washington D.C.: Government Printing Office, 1947), 326-27, 330.
336. "Annual Report of the Superintendent of Yellowstone National Park for 1948," 2, 12-13, 15.
337. "Annual Report of the Superintendent of Yellowstone National Park for 1949," 2, 4, 14-15, 17-18, 22.
338. *Annual Report of the Director of the National Park Service to the Secretary of The Interior for the Fiscal Year Ended June 30, 1949* (Washington D.C.: Government Printing Office, 1949), 302-04, 306.
339. Memorandum to NPS Region Two Director from Superintendent, Yellowstone National Park, 17 March 1950, File Box: 25, Yellowstone National Park, Folder: 630-01 Major Road Progress, National Archives and Records Administration, Denver, Colorado.
340. "Annual Report of the Superintendent of Yellowstone National Park for 1950," 17-20.
341. Frank Mattson, "Report July 1951 Road Cross Section Design, Construction Standards and Maintenance in Yellowstone National

Park and Grand Teton National Park, July 1951," Record Group 79, Yellowstone National Park, Box 25, File: Construction Projects, National Archives and Records Center, Denver, Colorado.

Mattson's report gives a good summary of the changes in the road standards revealing the results of decades of changes. This report can be found in the Appendices.

342. "Report on Yellowstone Park Maintenance, Yellowstone National Park, Wyoming, June 19 to 23, 1952," Record Group 79, Yellowstone National Park, Box 25, File: Roads, General, National Archives and Records Administration, Denver, Colorado.

343. In 1955, a list of roads and trails cost estimates was submitted to the Regional Director. This list is enclosed as an appendix because it reveals the inadequacies and needs of the system in 1955.

344. Memorandum to Superintendents, Yellowstone National Park and Glacier National Park, from NPS Region Two Director, 3 March 1955, Record Group 79, Yellowstone National Park, Box 10, National Archives and Records Administration, Denver, Colorado.

345. Bernard DeVoto, "Let's Close the National Parks," *Harper's Magazine* October, 1953, 49-52.

346. *Ibid.*, 546-50.

347. "MISSION 66 For Yellowstone National Park," National Park Service, United States Department of Interior, unpublished document, Library, Rocky Mountain Regional Office, Denver, Colorado.

348. *Ibid.*

349. Memorandum to Chief, Western Office, Division of Design and Construction, through Chief, Division of Design and Construction, from Assistant Director of National Park Service Thomas Allen, 13 February 1956, Record Group 79, Yellowstone National Park, Box 10, Roads, National Archives and Records Administration, Denver, Colorado.

350. Memorandum to Chief, Western Office, Division of Design and Construction from Park Landscape Architect Charles Krueger, 17 January 1956, Record Group 79, Yellowstone National Park, Box 10, National Archives and Record Center, Denver, Colorado.

351. *Ibid.*

352. See Appendices for the Major and Minor Road Program for 1957-1967. Record Group 79, Yellowstone National Park, Box 10, National Archives and Records Center, Denver, Colorado.

353. Memorandum to Region Two Director, National Park Service, from Superintendent, Yellowstone National Park, 17 August 1956; K. S. Chamberlain, Division Engineer, Bureau of Public Roads, to Rogers, 6 September 1956; Memorandum to Regional Two Director, National Park Service, from Superintendent, Yellowstone National Park, 13 September 1956, Record Group 79, Yellowstone National Park, Box 10, National Archives and Records Administration, Denver, Colorado.

354. Harold Bradley, "Roads in Our National Parks," *National Parks Magazine*, February 1959, 6.

355. The fourteen major bridges constructed during the Mission 66 period:

Yellowstone River Bridge.....	1961
Lewis River Bridge.....	1960
Madison River Bridge.....	1958
Gardner River Bridge.....	1958
Gardner River Bridge.....	1957
Chittenden Memorial Bridge.....	1962
Bridge Bay Bridge.....	1961
Firehole River Bridge.....	1967
Nez Perce Creek on Fountain Freight Rd...	1965
Gibbon River Bridge.....	1960
Gibbon River Bridge.....	1960
Gibbon River Bridge.....	1960
Beryl Springs Bridge.....	1962
Gibbon River Bridge.....	1960

356. The four bridges built during the 1970s were the following:

South Entrance Bridge.....	1972
Thumb Creek Bridge.....	1972
Firehole River Bridge.....	1970
Golden Gate Viaduct.....	1977